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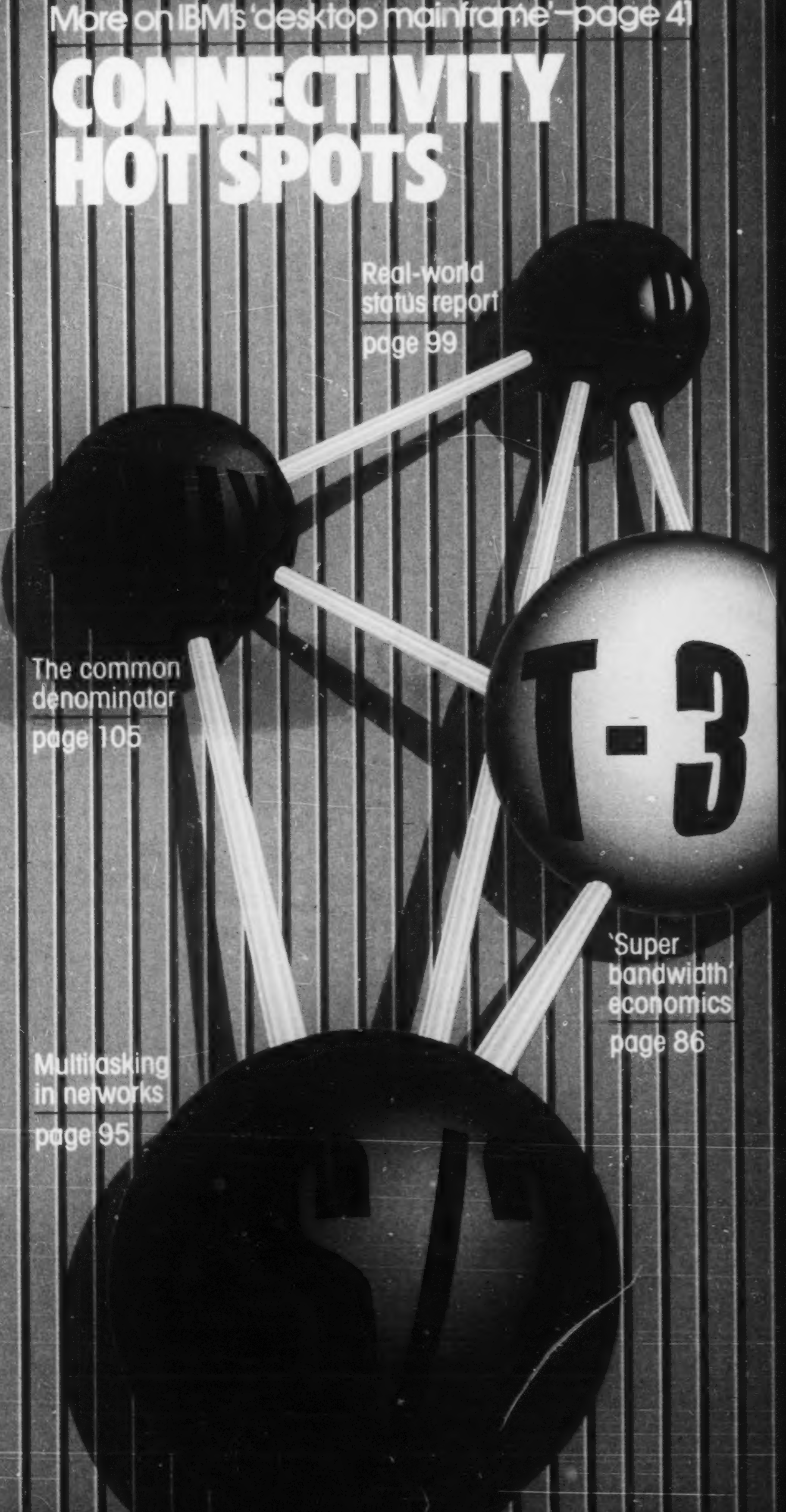

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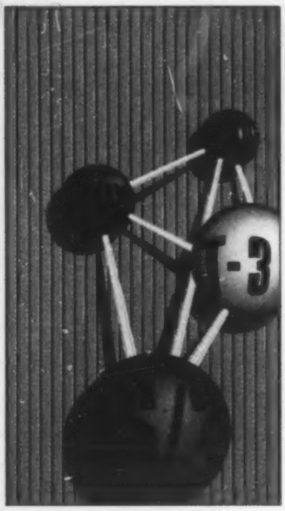

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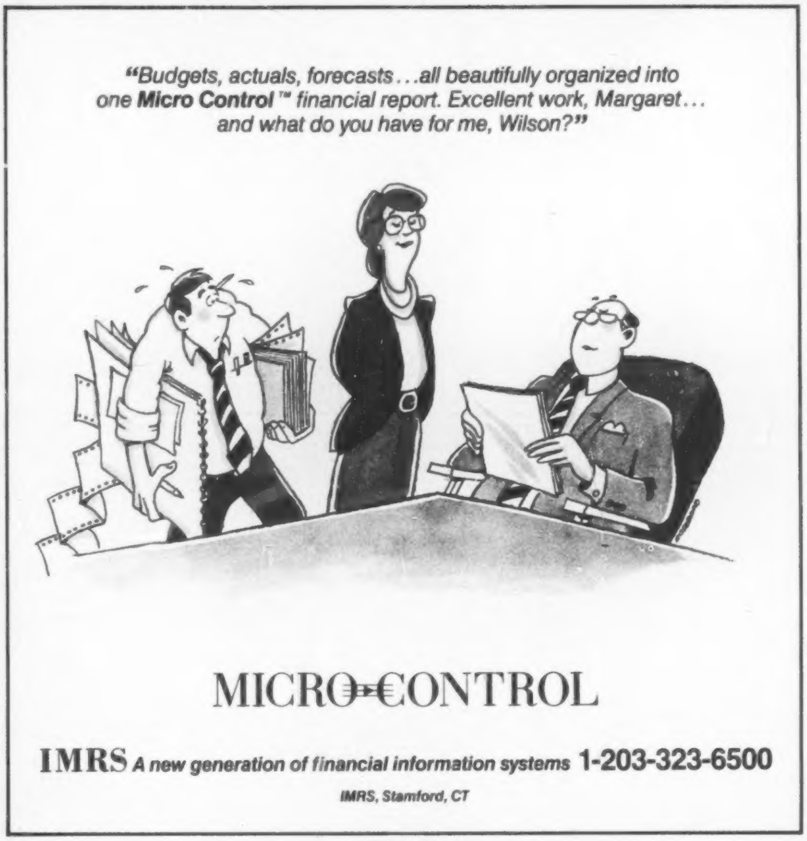

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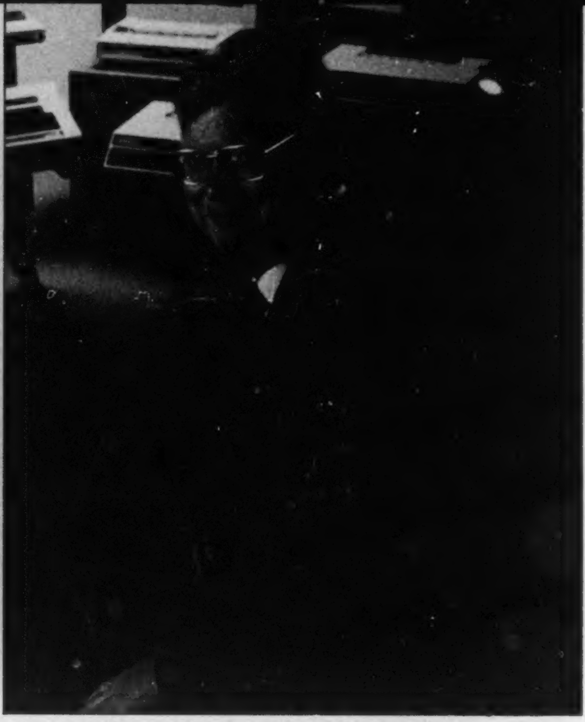
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Bruce Bastion, of Wordperfect Corp., and Curtis Powell, of Genicom, each presided over a booming year.

PERFORMANCE REPORT

Micro industry: Gloom follows boom

With the PS/2, IBM has reasserted its control over the largest portion of the microcomputer market. Some analysts believe the challenge to clone makers will cause a shakeout.

by Lee Keough

After watching its imitators cash in on an industry rebound while its sales fell some 10 percent, IBM changed the ground rules of the microcomputer market this year with its Personal System/2. The market won't be the same.

The PS/2 raises the ante for everyone in the IBM-compatible market. It's more difficult—and expensive—to develop software and add-ons for the new machine than for the Personal Computer series. For that reason, among others, analysts expect a shakeout soon.

"It used to be that any kid out of engineering school could knock off the PC," says Jonathon Yarmis, research analyst at the Gartner Group Inc., Stamford, CT. "The PS/2 requires some manufacturing ability." Higher costs, he says, will lessen the market appeal for a number of manufacturers. "Schlock outfits will go on to sell the next hula hoop," he remarks.

The 1987 DECISIONS Performance Report on the micro industry is based on financial data for the 12 months ending March 31. Thus, it is more a depiction of the rebound in the industry that occurred last year than it is a picture of an industry in transition. The possible effects of the PS/2 on vendors in IBM PC-related markets are only now becoming apparent—they won't show up in financials until the end of this year at the earliest.

Indeed, micro sales exploded immediately after the PS/2 announcement. Increased buying probably reflected purchasing plans that were deferred until buyers saw IBM's long-rumored second-generation micros. IMS America Ltd., a Plymouth Meeting, PA-based market researcher, estimates U.S. sales of micros for the quarter ending in June at $412 million, a 63 percent increase from the same period a year earlier.

It's too early to tell how much of the market IBM will grab with the PS/2. Data from the second DECISIONS/Paine Webber Survey of MIS Attitudes indicate significant interest among MIS buyers in both the machine and its operating system, Operating System/2. IMS America pegs early shipments at about 65 percent of the market. IBM says it shipped more than 300,000 PS/2s—most of them to dealers—before the end of June.

The year before the PS/2's announcement will probably be remem-

'87	'86	Company	'87 Revenues (000)	'86 Revenues (000)	% Growth
		Computers			
1	1	Apple Computer Inc. *(Cupertino, CA)*	**2,196,645**	1,727,472	27
2	2	Tandy Corp. *(Fort Worth, TX)*	**1,603,933**	1,469,447	9
3	3	Compaq Computer Corp. *(Houston)*	**692,212**	550,870	26
4	4	Zenith Electronics Corp. *(Glenview, IL)*	**548,000***	352,000	56
5	5	NEC Information Systems Inc. *(Boxborough, MA)*	**340,000**	218,000	56
6	6	Tandon Corp. *(Chatsworth, CA)*	**158,982**	96,000	66
7	8	Kaypro Corp. *(Solana Beach, CA)*	**102,236**	66,080	55
8	7	Telxon Corp. *(Akron, OH)*	**100,819**	82,095	23
9		Dell Computer Corp. (PC's Limited) *(Austin, TX)*	**69,450**	N/A	N/A
10	9	Grid Systems *(Fremont, CA)*	**60,000****	56,600**	-6
11		Leading Edge Products Inc. *(Canton, MA)*	**40,000**	N/A	N/A
12	10	Fortune Systems Corp. *(Belmont, CA)*	**34,948**	49,359	-29
13	15	Blue Chip Electronics Inc. *(Chandler, AZ)*	**30,000****	6,000**	400
14	12	Wicat Systems *(Orem, UT)*	**28,040**	39,405	-29
15	11	Victor Technologies Inc. *(Scotts Valley, CA)*	**25,959**	49,260	-47
		Total Computers	**6,031,224**	4,762,588	26.6
		Peripherals			
1	1	Epson America Inc. *(Torrance, CA)*	**250,000**	175,000	43
2	2	AST Research Inc. *(Irvine, CA)*	**182,818**	174,682	5
3	5	Intelligent Systems, Master L.P. *(Norcross, GA)*	**152,770**	125,541	22
4	3	Printronix Inc. *(Irvine, CA)*	**123,651**	131,892	-6
5	6	Quantum Corp. *(Milpitas, CA)*	**120,760**	121,244	0
6	4	Iomega Corp. *(Roy,UT)*	**107,446**	127,275	-16
7	8	Genicom Corp. *(Waynesboro, VA)*	**107,006**	75,555	42
8	7	Brother International Corp. *(Piscataway, NJ)*	**102,000***	92,000	11
9	11	QMS Inc. *(Mobile, AL)*	**95,384**	55,054	73
10	9	Toshiba America Inc. *(Tustin, CA)*	**90,000**	70,000	29
11	14	CMS Enhancements Inc. *(Tustin, CA)*	**80,133**	34,000	136
12	10	Okidata Corp. *(Mount Laurel, NJ)*	**75,000**	60,000	25
13	12	Hercules Computer Technology *(Berkeley, CA)*	**70,000**	50,000	40
14	17	Everex Systems Inc. *(Fremont, CA)*	**63,327****	18,790**	23
15	15	Mountain Computer Inc. *(Scotts Valley, CA)*	**51,000****	29,000**	76
		Total Peripherals	**1,671,295**	1,340,033	24.7
		Software			
1	2	Microsoft Corp. *(Redmond, WA)*	**308,087**	172,473	79
2	1	Lotus Development Corp. *(Cambridge, MA)*	**298,382**	250,117	19
3	3	Ashton-Tate Corp. *(Torrance, CA)*	**210,799**	121,571	73
4	8	WordPerfect Corp. *(Orem,UT)*	**62,176**	28,996	114
5	7	Autodesk Inc. *(Sausalito, CA)*	**52,381**	29,531	77
6	4	Softech Inc. *(Waltham, MA)*	**44,353**	42,334	-5
7	5	Micropro Intl. Corp. *(San Rafael, CA)*	**34,995**	41,859	-16
8	9	Software Publishing Corp. *(Mountain View, CA)*	**30,599**	28,779	6
9	6	Digital Research Inc. *(Monterey, CA)*	**30,000***	35,000*	-14
10	10	Borland International *(Scotts Valley, CA)*	**29,200**	27,100	8
11	19	Adobe Systems Inc. *(Palo Alto, CA)*	**20,531**	4,604	346
12	12	Innovative Software Inc. *(Lenexa, KS)*	**17,325**	10,325	66
13	16	The Santa Cruz Operation Inc. *(Santa Cruz, CA)*	**17,100***	6,100*	180
14	14	Microrim Inc. *(Redmond, WA)*	**15,200***	7,500*	-103
15	11	Micro Data Base Systems Inc. *(Lafayette, IN)*	**13,200***	12,500*	6
		Total Software	**1,184,328**	818,891	44.6
		Total Computers, Peripherals, and Software	**8,886,847**	6,921,512	28.4

bered with fondness by most vendors. As the numbers indicate, business was brisk, particularly in the IBM PC-compatible market. Analysts attribute the market's renewed vigor to a combination of a normal upswing in the business cycle and deep discounts and price cutting. Standardization and improved connectivity products also contributed to the resurgence.

IBM-compatible vendors were not the only beneficiaries of last year's boom. Apple Computer Inc. bounced back from near oblivion to strengthen its position as the second-largest micro maker. For the quarter ending in June, IMS America estimates, sales of the Apple Macintosh were up 187 percent over the same period the year before. With the Macintosh II, Apple opened its architecture and provided new connections to MS-DOS. "Apple is doing all the right things," says Yarmis at the Gartner Group.

But for MIS, the IBM standard, not the Mac, is where it's at. No one—except Apple, perhaps—believes the

Total '87 Revenues (000)	Total '87 Profits (000)
2,196,645	157,565
5,791,459	380,683
692,212	54,726
1,892,100	(10,000)
218,000	340,000
264,970	(59,419)
102,236	3,884
100,819	12,730
69,450	2,161
60,000	N/A
N/A	N/A
34,948	(3,505)
30,000	N/A
28,040	11,567
25,959	(7,404)
250,000	N/A
182,818	14,521
152,770	2,475
123,651	(4,892)
120,760	41,491
107,446	(15,660)
181,366	9,360
275,000	N/A
95,384	8,084
476,000	N/A
80,133	N/A
120,000	N/A
63,327	3,401
51,000	N/A
41,644	2,157
308,087	66,128
298,382	50,636
210,799	30,100
62,176	N/A
52,381	11,620
44,353	448
34,995	(2,177)
30,599	2,537
30,000	N/A
29,200	2,100
20,531	4,418
17,325	2,779
17,100	N/A
15,200	N/A
13,200	N/A

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Unless otherwise noted annual revenues are based on the four fiscal quarters ending on or before March 31.

ON A FAST TRACK . . .

	Company	'87 Revenues (000)	% Growth	'86 Revenues (000)
1	Blue Chip Electronics Inc.	30,000	400	6,000
2	Adobe Systems Inc.	20,531	346	4,604
3	Everex Systems Inc.	63,327	237	18,790
4	The Santa Cruz Operation Inc.	17,100	180	6,100
5	CMS Enhancements Inc.	80,133	136	34,000
6	Wordperfect Corp.	62,176	114	28,996
7	Microrim Inc.	15,200	103	7,500
8	Microsoft Corp.	308,087	79	172,473
9	Autodesk Inc.	52,381	77	29,531
10	Mountain Computer Inc.	51,000	76	29,000

. . . FALLING OFF THE PACE

	Company	'87 Revenues (000)	% Growth	'86 Revenues (000)
1	Victor Technologies Inc.	25,959	-47	49,260
2	Fortune Systems Corp.	34,948	-29	49,359
3	Wicat Systems	28,040	-29	39,405
4	Micropro Int'l. Corp.	34,995	-16	41,859
5	Iomega Corp.	107,466	-16	127,275
6	Digital Research Inc.	30,000	-14	35,000
7	Printronix Inc.	123,651	-6	131,892
8	Quantum Corp.	120,760	0	121,244

DECISIONS chart

Mac is a serious threat to the IBM PC or PS/2 in corporate applications. The IBM market is where most of the growth is. Indeed, the clone business was so hot last year that it attracted peripheral vendors Tandon Corp. (disk drives), AST Research Inc. (add-on boards), and Epson America Inc. (printers). Each redirected its resources to develop complete systems.

Both high- and low-cost imitators of the IBM and DOS standards say they can continue to compete favorably with IBM, although it should become more expensive to do so. OS/2 will run on most micros based on Intel 80286 and 80386 processors, clones included. The PS/2's wrinkles—its Micro Channel bus, a smaller size (which will force add-on board makers to produce smaller, denser products), a new Video Graphics Array standard, and 3½-inch disk drives—will cause problems for clone makers, however.

IBM-compatible vendors say the PS/2's Micro Channel and its small size are its two most troublesome features. The Micro Channel, which allows for multitasking and faster access to disk drives, will be the most difficult feature for the clone makers to emulate. But it will be emulated.

At least one competitor is unimpressed by Micro Channel. "The Micro Channel is a myth," offers Graham Beachum, vice president of sales and marketing for Dell Computer Corp., which sells the PC's Limited brand. "It's another example of IBM spreading fear, uncertainty and doubt [among users]." But Ted Bajarin of Creative Strategies, a Santa Clara, CA, consultancy, believes Micro Channel gives IBM legal leverage against imitators. "If it wanted to, IBM could hang you up in court," he says.

AST Research asserts that the IBM PC AT's bus augmented by the new Lotus, Intel, Microsoft Extended-Memory Specification is as good as the Micro Channel. The spec makes more than 640 Kbytes of memory—enough for multitasking—available to users of MS-DOS machines.

Add-on board makers may be the most seriously affected by the PS/2. AST Research says the new boards will require manufacturers to retool to employ the surface mount technology needed to produce denser circuitry. Analysts expect this requirement to keep down the number of vendors in the PS/2 add-on market.

Software: A gold mine

Business boomed for microcomputer software vendors last year; the top 15 micro software marketers grew nearly 45 percent. Micro software vendors skipped the slump of 1985, and the future should also remain bright, despite PS/2. Wordperfect Corp. was the biggest surprise, moving up to the fourth spot among micro software vendors, and possibly setting a standard within the fragmented word processing market.

"We haven't taken the market by storm by any means," says Andre Peterson, director of PC marketing for Wordperfect, "but we're getting beyond our original cult following." Wordperfect's success, says Peterson, is due not only to the program's features, but also its ability to run on numerous hardware platforms, including the Digital Equipment Corp. VAX.

Meanwhile, Micropro International Corp., whose Wordstar was once the leading light in micro word processing, is one of the few software houses to have fallen on hard times.

Most analysts expect OS/2 to gain dominance only slowly. But OS/2 need not be dominant to change the fortunes of software vendors. Peterson estimates that development projects for OS/2 applications will cost at least $1 million to $2 million each. Small developers hoping to jump on the new standard (as Lotus did with MS-DOS) will obviously be hampered by this high cost of entry, says Peterson. However, even large companies will be hurt, if they're marginally profitable. Just converting existing packages to OS/2 will burn up a lot of capital.

At the same time, software vendors may find customer requirements changing, says Robert Therrian, an analyst at Paine Webber Inc., New York. He expects much OS/2 development by users. "The complexity of OS/2 encourages customization of applications," he says.

Analysts believe the best-positioned vendors are Microsoft, Lotus Development Corp., and Ashton-Tate. Not only can they afford to rewrite their programs for OS/2, but they also sell the tools allowing users to customize applications. Lotus's most serious competition is likely to come from Microsoft, which recently announced PC Excel, a graphically oriented spreadsheet. Lotus has mounted a counterattack by anouncing 1-2-3 for the Macintosh, a market that Excel currently dominates. Lotus's trump card, however, will be its special development agreement with IBM to put 1-2-3 on mainframes.

Of the three, only Ashton-Tate doesn't have a close relationship with IBM. Although that fact initially caused concern about Ashton-Tate's future, its 73 percent growth rate put those fears to rest. Lotus and Ashton-Tate have been able to maintain their grip on their markets despite an assault from low-cost clones. And they've been able to do it without cutting prices. That fact signifies to Bajarian that the cost of micro software will remain stable. "If anything, prices will go up," he says.

Ashton-Tate, like almost every vendor in the micro market, should see its fortunes change as a result of the PS/2. Vendors with a carefully chosen strategy can float inside IBM's current—and that is expected to run at a rapid pace in the year ahead. **D**

Laura Daly, a free-lance editor based in Maywood, NJ, contributed to this report.

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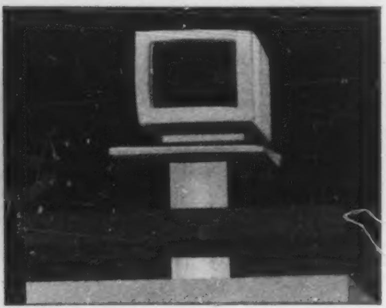
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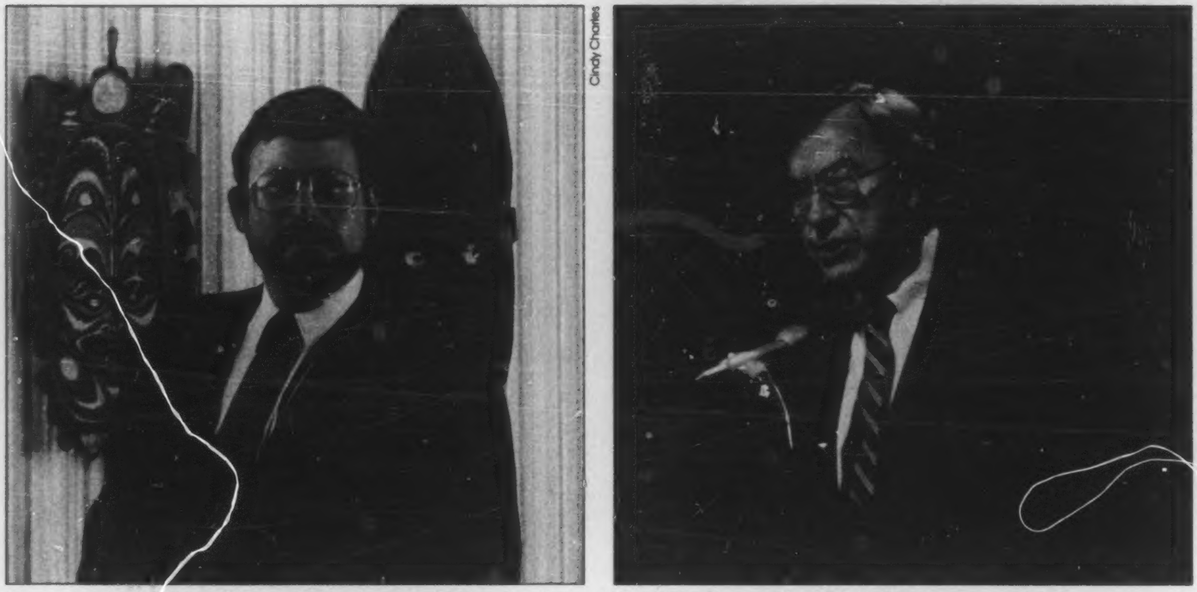

Cindy Charles

Courtesy Novell Inc.

Bruce Smith (left) at Network Equipment Technologies and Ray Noorda at Novell led their troops to big years.

PERFORMANCE REPORT

Communications: Connectivity finally connects

User demands for connectivity finally made the 'year of the LAN' a reality. But for old-line communications vendors, last year was less than stellar.

by Lee Keough

Connectivity has become more than a buzzword in the past year. Corporations seeking to leverage investments in existing information systems bought networking products by the bushel; as a result, vendors of T-1 multiplexers or local-area networks watched sales soar. But for those selling more conventional communications products, such as modems and statistical multiplexers, the year was less than awe inspiring.

The 35 largest communications equipment vendors showed a moderate 14 percent growth, about the same as in recent years. Individual market segments—as well as individual vendors within those markets—demonstrated widely divergent results, however. Carriers grew only 3 percent, in part due to regulatory constraints on pricing. At Novell Inc., a vendor of local-area network operating systems, and Network Equipment Technologies, a T-1 multiplexer maker, revenues grew at a blistering pace for the 12 months ending June 30. Novell and NET weren't the only suppliers able to capitalize on the networking trend; most of their competitors recorded impressive sales and profits.

The spectacular growth of networking products is most obvious in the LAN market. After struggling with slim profits and lackluster sales for some time—and touting each successive year as the "year of the LAN"—LAN vendors finally started turning the corner at the end of 1986. Bill Redman, an analyst with the Gartner Group Inc. in Stamford, CT, estimates that the LAN market doubled in 1986, to $1 billion. He pegs sales in 1987 at $1.25 billion.

"Three years ago, the question was, 'Should we or shouldn't we install LANs?' " says Redman. "But once systems vendors endorsed the idea by either providing LANs themselves or providing gateways, the market just took off." Once-raging debates over the merits of different types of LANs have also subsided, notes Brian NeSmith of Network Strategies Inc., a Fairfax, VA, consultancy.

Certainly, LANs offer many more features than they did just a few years ago. LAN software has moved beyond the simple document transfer stage and now affords powerful electronic-mail functions, gateways into wide-area networks, and improved user interfaces. More importantly, MIS now backs the LAN concept. "MIS departments see micro LANs as viable, and they've taken control from the workgroup," says Mark Caulkins, vice president of corporate marketing for Novell, whose Netware

'87	'86	Company	'87 Revenues (000)	'86 Revenues (000)	% Growth
		Equipment and Services			
1	1	Northern Telecom Inc. *(Nashville, TN)*	**1,374,310**	1,222,930	12
2	2	The Racal Electronics Plc *(Bracknell, England)*	**520,401***	485,970*	7
3	3	Motorola Inc. *(Schaumburg, IL)*	**465,000**	428,000	9
4	5	Centel Corp. *(Chicago)*	**295,097***	235,966*	25
5	4	Paradyne Corp. *(Largo, FL)*	**241,954**	251,181	-4
6	8	Bolt Beranek and Newman Inc. *(Cambridge, MA)*	**233,841**	178,049	31
7	6	Dynatech Corp. *(Burlington, MA)*	**231,567****	205,773**	13
8	9	General Datacomm Industries Inc. *(Middlebury, CT)*	**201,313**	174,482	15
9	7	Micom Systems Inc. *(Simi Valley, CA)*	**199,630**	189,308	5
10	10	Digital Communications Associates Inc. *(Alpharetta, GA)*	**181,399**	150,705	20
11	12	Mitel Inc. *(Boca Raton, FL)*	**162,450****	149,700**	9
12	14	Timeplex Inc. *(Woodcliff Lake, NJ)*	**147,170**	119,118	24
13	11	Hayes Microcomputer Products Inc. *(Atlanta)*	**140,000****	150,000**	-7
14	16	Ungermann-Bass Inc. *(Santa Clara, CA)*	**129,487**	90,343	43
15	22	Novell Inc. *(Provo, UT)*	**127,855**	60,099	113
16	13	Western Union Corp. *(Upper Saddle River, NJ)*	**123,200**	130,400	-6
17	21	3Com Corp. *(Santa Clara, CA)*	**110,377**	63,992	72
18	15	Network Systems Corp. *(Minneapolis)*	**109,543**	95,985	14
19	17	Gandalf Technologies Inc. *(Manotick, Ontario)*	**100,295**	83,322	20
20	18	Infotron Systems Corp. *(Cherry Hill, NJ)*	**77,366**	76,753	1
21	20	Ericsson Inc. *(Richardson, TX)*	**63,753***	69,299*	-8
22	24	Tellabs Inc. *(Lisle, IL)*	**59,669**	51,775	15
23	27	Bridge Communications Inc. *(Mountain View, CA)*	**59,218**	37,966	56
24	34	Network Equipment Technologies *(Redwood City, CA)*	**58,028**	14,808	292
25	23	Penril Corp. *(Rockville, MD)*	**56,346**	52,239	8
26	25	Icot Corp. *(San Jose, CA)*	**51,050**	45,064	13
27	19	Sytek Inc. *(Mountain View, CA)*	**40,000**	70,000	-43
28	26	Corvus Systems Inc. *(San Jose, CA)*	**36,053**	42,137	-14
29	28	Fibronics International Inc. *(Hyannis, MA)*	**34,927**	28,282	23
30	30	Telematics International Inc. *(Fort Lauderdale, FL)*	**32,721**	20,000	64
31	29	Anderson Jacobson *(San Jose, CA)*	**26,500****	23,000**	15
32	31	US Robotics Inc. *(Skokie, IL)*	**25,000****	20,000**	25
33	35	Excelan Inc. *(San Jose, CA)*	**22,049**	9,907	123
34	33	Multi-Tech Systems Inc. *(New Brighton, MN)*	**20,000***	15,260*	31
35	32	Avant-Garde Computing Inc. *(Mt. Laurel, NJ)*	**17,358****	16,309**	6
		Total Equipment and Services	**5,774,927**	5,058,122	14
		Carriers			
1	1	AT&T *(New York)*	**34,478,000**	35,185,000	-2
2	3	Nynex Corp. *(New York)*	**11,730,000**	10,749,800	9
3	2	Bell South Corp. *(Atlanta)*	**11,686,900**	11,206,500	4
4	4	Bell Atlantic *(Philadelphia)*	**10,194,200**	9,488,400	7
5	5	Ameritech Corp. *(Chicago)*	**9,385,900**	9,207,700	2
6	6	Pacific Telesis *(San Francisco)*	**8,975,000**	8,799,000	2
7	7	U.S. West Inc. *(Englewood, CO)*	**8,372,100**	8,052,200	4
8	8	Southwestern Bell Corp. *(St. Louis)*	**7,740,200**	7,943,900	-3
9	9	MCI Communications Corp. *(Washington)*	**3,737,000**	3,132,000	19
10	10	United Telecommunications Inc. *(Kansas City, MO)*	**2,857,227***	2,805,751*	2
11	11	Contel Corp. *(Atlanta)*	**2,756,560**	2,496,088	10
12		US Sprint Communications Co. *(Arlington, VA)*	**2,301,896**	N/A	N/A
13	12	Allnet Communication Services Inc. *(Birmingham, MI)*	**449,734***	432,113*	4
		Total Carriers	**114,664,717**	109,498,452	3†
		Total Communications	**120,439,644**	114,556,754	

is the most popular software running on LANs. Novell, the largest and one of the best-performing LAN vendors last year, decided to de-emphasize its hardware offerings and concentrate on developing more functionality for its software package, which runs on almost all LANs.

Caulkins envisions new growth once Novell's Netware becomes available for Apple Macintosh networks and Unix-based LANs. He adds that Netware may soon offer networking features that mainframe systems software vendors now provide, such as security, network management, and job accounting.

Novell's primary competitor, 3Com Corp., is taking a different tack. In September, 3Com merged with Bridge Communications Inc., which specializes in multivendor LANs and connections to wide-area networks. L. William Krause, 3Com's president and CEO, says the merged company, which will carry the 3Com name, will emphasize "workgroup systems"—

Total '87 Revenues (000)	Total '87 Profits (000)
4,739,000	316,900
2,065,355	73,085
5,888,000	194,000
1,418,821	109,802
241,954	(43,282)
233,841	(8,029)
304,693	23,205
201,313	4,814
199,630	13,450
181,399	28,433
340,005	60,400
147,170	19,508
150,000	N/A
129,487	5,513
127,855	14,809
889,192	(531,205)
110,377	11,146
109,543	17,206
100,295	N/A
77,366	(6,490)
4,633,000	310,000
119,337	8,792
59,218	6,449
58,028	7,666
56,346	4,959
51,050	7,950
40,000	N/A
36,053	(19,780)
34,927	(1,235)
32,721	5,164
N/A	N/A
25,000	N/A
22,049	N/A
20,000	N/A
17,358	(6,427)

Total '87 Revenues (000)	Total '87 Profits (000)
34,478,000	404,000
11,730,000	1,229,900
11,686,900	1,594,900
10,194,200	1,203,400
9,385,900	1,134,000
8,975,000	1,059,000
8,372,100	947,200
7,740,200	983,900
3,737,000	(451,000)
3,058,783	180,561
3,070,049	228,576
2,301,896	N/A
449,734	(60,780)

*CY '86 and '85 **FY N/A Not Available
All other revenues are calculated using the four fiscal quarters ending closest to June 30.
†Total growth rates are based only on known comparative revenues.

GAINING STRENGTH . . .

Company	'87 Revenues (000)	% Growth	'86 Revenues (000)
1 Network Equipment Technologies	58,028	292	14,808
2 Excelan	22,049	123	9,907
3 Novell	127,855	113	60,099
4 3Com	110,377	72	63,992
5 Telematics International	32,721	64	20,000
6 Bridge Communications	59,218	56	37,966
7 Ungermann-Bass	129,487	43	90,343
8 Bolt Beranek and Newman	233,841	31	178,049
9 Multi-Tech Systems	20,000*	31	15,260*
10 Centel	295,097	25	235,966

. . . LOSING GROUND

Company	'87 Revenues (000)	% Growth	'86 Revenues (000)
1 Sytek	40,000	-43	70,000
2 Corvus Systems	36,053	-14	42,137
3 Ericsson	63,753*	-8	69,299*
4 Hayes	140,000**	-7	150,000**
5 Western Union	123,200	-6	130,400
6 Paradyne	241,954	-4	251,181
7 Southwestern Bell	7,740,200	-3	7,943,900
8 AT&T	34,478,000	-2	35,185,000
9 Infotron Systems	77,366	1	76,753
10 United Telecommunications	2,857,227*	2	2,805,751*

*CY '86 **FY

DECISIONS chart

file servers and operating systems. "We are taking a total systems approach," says Krause. To compete with workstation vendors, 3Com will have to provide superior price/performance numbers, he acknowledges.

Analysts say competition will get much stiffer as major hardware vendors incorporate LAN capabilities into their products. "The key issue is how soon and how well systems vendors address the market," says David L. Terrie, president of Newport Consulting, Scituate, MA. Redman predicts the market will begin to change as early as next year. "IBM, for example, will put the Token-Ring Network on a chip set and package it inside the Personal System/2 in 1988," he speculates. "We'll also see a [Digital Equipment Corp.] DECnet board on the MicroVAX." Terrie expects such moves to lead to tremendous price cuts for LAN hardware, causing an industry shakeout. "The bottom won't fall out immediately," he says, "but we'll see a major shift in emphasis by 1989 and 1990."

IBM to turn up the heat

Other analysts suggest that Novell may start feeling some heat from IBM and Microsoft Corp (Redmond, WA). Microsoft's announced Operating System/2 LAN Manager and IBM's OS/2 Extended Edition are expected to offer many of the features now included in Netware. "The LAN Manager has more potential for the future than Netware has," offers Will Zachmann, vice president of International Data Corp., Framingham, MA-based market researchers. Redman, however, asserts that the operating systems will lag behind Netware in offering features. He adds that even if those operating systems perform many of the same functions, they won't displace Netware.

Not all LAN vendors scored successes last year. Corvus Systems Inc. and Sytek Inc. both struggled through the year. Corvus's troubles stemmed largely from its decision to manufacture IBM-compatible micros and disk drives. Although Corvus still sells micros, including a machine based on the Intel 80386 processor, it has cut back on its involvement in the workstation business. After a major restructuring that included a large layoff, Corvus recently announced its first profitable quarter since 1985. Sytek, maker of IBM's broadband-based PC Network, continues to suffer from the loss of IBM's business since IBM switched to Token-Ring Network as its standard LAN architecture. Sytek once boasted annual sales as high as $95 million; last year, its revenues only reached about $40 million.

A clearer picture

The market for private T-1 networks doesn't appear to have as many question marks as the LAN market. Observers say the T-1 multiplexer market should continue to grow. But only a handful of vendors have been able to capitalize on the boom in private corporate networks.

The fastest-climbing of all communications vendors is Network Equipment Technologies, which has experienced nothing short of an astounding sales growth of nearly 300 percent in one year. Bruce D. Smith, president, expects growth to slow to about 80 percent this year—still beyond the dreams of most vendors. Few analysts doubt NET will achieve that mark. Its strengths are in marketing and in the multiple-node switching capability it offers in its T-1 mux.

Observers say NET and Cohesive Network Corp., owned by Digital Communications Associates Inc. of Alpharetta, GA, sell the most feature-rich T-1 systems. Timeplex Inc., the T-1 mux vendor with the largest installed base, is trying to catch up with its newly announced Link 100 mux. NET has another ace up its sleeve, however; it recently signed a marketing and development deal with IBM. "We've gone from 50 to 5,000 sales reps," says Smith. "IBM is going to help us in development, so our signaling protocols will be built into SNA."

Analysts say NET will benefit from the "stamp of approval" its affiliation with IBM provides. But Victoria Brown, senior vice president of marketing for Timeplex, contends the benefit may not be great at all. "NET has turned its business over to IBM," she says. "Of course, we expect the agreement to influence some users." Brown is quick to point out that in the past IBM has had difficulty making its partnerships work.

Timeplex plans to position itself as the vendor best able to implement global networking, says Brown. She sees AT&T, which is beginning to offer many private networking features in its Accunet T-1.5 service, as a major competitor. George Colony, president of Forrester Research Inc. of Cambridge, MA, also views AT&T as a threat to T-1 mux vendors.

Courtesy AT&T

Vittorio Cassoni, senior vice president of AT&T's Data Systems Division, faces the task of helping to get the carrier's subpar performance back on track.

Unlike many observers, Colony doesn't believe that private networks will continue to grow unabated. He projects that the T-1 market, which he says is becoming saturated, will grow only 15 percent next year, compared with the 35 percent growth he estimates for this year. Colony says his survey of large users shows that they are interested in private backbone networks for fairly narrow applications. He believes private networks have already been installed for most of those applications, and says the next boom in private networks will come in several years, when T-1 customers move to install T-3 services.

Others assert that the T-1 market has yet to peak. "We're just starting to see global networks growing," says Jack Grubman, an analyst with Paine Webber Inc., a Wall Street brokerage. He says that better price/performance ratios are making private networks feasible for more companies. "As the price of bandwidth drops, more features are being added to muxes, while prices remain the same," he notes. "More customers will flock to T-1 networks."

While the LAN and T-1 markets flourish, other communications sectors founder. Sales of modems, private branch exchanges, and statistical multiplexers are flat, and profits are being squeezed due to the commodity status of these products. The trend, say analysts, will continue. That spells more trouble for U.S.-based vendors, which are not well equipped to be low-cost manufacturers. To compete, U.S. companies will have to stay on the leading edge of technology or offer greater service. Observers contend that the only way modem and stat mux vendors can improve their fortunes is through strategic alliances with T-1 multiplexer manufacturers.

The slowest growing communications market last year was the carrier segment. Particularly hard-hit are the non-Bell carriers, which have to stay within the price umbrella set by regulations and competition but lack the mammoth customer bases to absorb upgrade costs. Bell regional holding companies all turned in handsome profits last year. Nynex Corp. and Bell Atlantic Corp. in particular posted impressive gains, thanks largely to the healthy Northeast economy.

Grubman says comparing the performance of the Bell regionals on the basis of revenues is misleading because of differing state regulations. Instead, he uses message units as a yardstick to gauge performance. Under that criterion, Bell Atlantic, Nynex, and Pacific Telesis are by far the strongest of the Bell regionals. "Bell South, which was thought to have the greatest potential for growth, has lagged because its growth is nearly all residential," Grubman notes.

AT&T faces a unique set of problems: It has been a notable flop in the computer business, it is likely to lose market share to lower-cost competitors, and it has faced stiff competition in telephone equipment sales from vendors like Northern Telecom Inc. and IBM/Rolm. Grubman, however, says AT&T's dismal performance is somewhat misleading. It was due mostly to a $3 billion write-down that the vendor took at the end of 1986. The write-down stemmed from large inventories of computers, high layoff costs, and the tight PBX market. AT&T's long-distance business is still in good shape, says Grubman.

AT&T isn't alone in feeling the long-term effects of tariff deregulation. Other carriers—some of which encouraged the deregulation of rates—are finding it harder to make a profit. Deregulation is also the major factor driving the installation of private networks—a trend that should continue in the year ahead. ■

Laura Daly, a free-lance editor based in Maywood, NJ, contributed to this performance report.

Computer & Communications
DECISIONS
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UNATTENDED OPERATIONS:
LET'S HEAR IT FOR NOBODY

EXCLUSIVE SURVEY:
SPENDING PLANS—AFTER THE CRASH

MIS PULLS OFF A CORPORATE TAKEOVER

WHY FIBEROPTICS MAKES SENSE NOW

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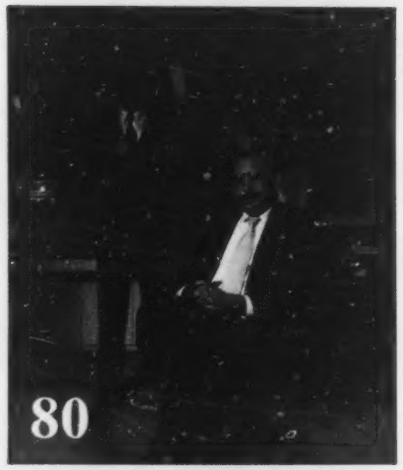

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THE SUPERMICRO CONSENSUS 28
The first MIS-designed, state-of-the-art microcomputer is on the assembly line, thanks to readers who participated in our survey.

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EDITOR'S MESSAGE

Things Are Looking Up

First, let me apologize for the teaser headline. I don't mean "things" in general. And I'm referring specifically to our things rather than yours. Our main thing, of course, is this magazine, and one main reason it's looking up is because it's looking better. This issue marks the inaugural of certain, shall we say, format modifications that are intended to make the information normally contained in this magazine more easily recognizable and accessible . . . but there I go, fudging again.

The fact is this: We want the layouts to be more attractive, and therefore more compelling, so you will immediately recognize what's good for you, then read it—*all* of it—and give us eternal credit. Let's be straight about that.

However well we have done in this regard is primarily a result of the efforts of a duo, comprising our art director, Janine Gevas, and associate art director Vince Gallo. Janine joined us recently from the Ziff-Davis Publishing Company; Vince has been here for three years and was recently promoted from assistant art director. Having worked with a number of art directors, it is my experience that most would rather have root canal *sans* anesthesia than redesign a publication—even partially—at the same time they are involved in the day-to-day production of it. In this regard, however, Janine hit the ground running and has only complained behind my back, if at all.

For those of you to whom the graphic design changes seem, well, subtle, let me be the first to congratulate you on the accuracy of your perceptions. That's exactly what they are supposed to be . . . but there I go again.

Personally, I think the difference is dramatic. But I'm neither judge nor jury in this case; you are. Let us hear from you on any aspect of the magazine—design, content, scope, emphasis—you think could be changed for the better, and give us the rationale as it applies to information technology executives and managers like yourself.

If you do, we'll give *you* eternal credit.

Robin Nelson

Cover Photo:
Ralph Mercer
(photo taken at
Wang Laboratories
Inc. Network
Services Data
Center, Lowell,
MA)

THE DECISIONS/PAINE WEBBER SURVEY

AFTER THE CRASH

The fourth DECISIONS/Paine Webber survey of MIS Attitudes shows MIS managers in an uncertain economy adjusting budgets only slightly.

by Lee Keough

Forget the notion that a tumbling stock market will have a disastrous effect on computer spending. Most MIS managers haven't altered their 1988 budgets at all, according to the fourth DECISIONS/Paine Webber survey of MIS attitudes. Of those that are reviewing budget plans, 21 percent say they are increasing spending; 28 percent are scaling back.

"There was some expectation that the crash would have a major impact on capital spending because pre-crash studies were very bullish for the computer industry," says Stephen K. Smith, first vice president at Wall Street brokerage Paine Webber Inc. "Even with a modest reduction in spending plans, I am very encouraged."

The survey was mailed in late November and processed in early December, more than a month after the market's historic October 19 crash, but before the more recent tumble last month, when computer stocks were among those hardest hit.

It should be no surprise that MIS managers working in government expect the deepest and widest cuts. A full 50 percent of those respondents expect to slash spending from previously planned levels. Twenty-two percent of those managers anticipate cuts of more than 10 percent. Only 13 percent of government MIS managers expect to increase

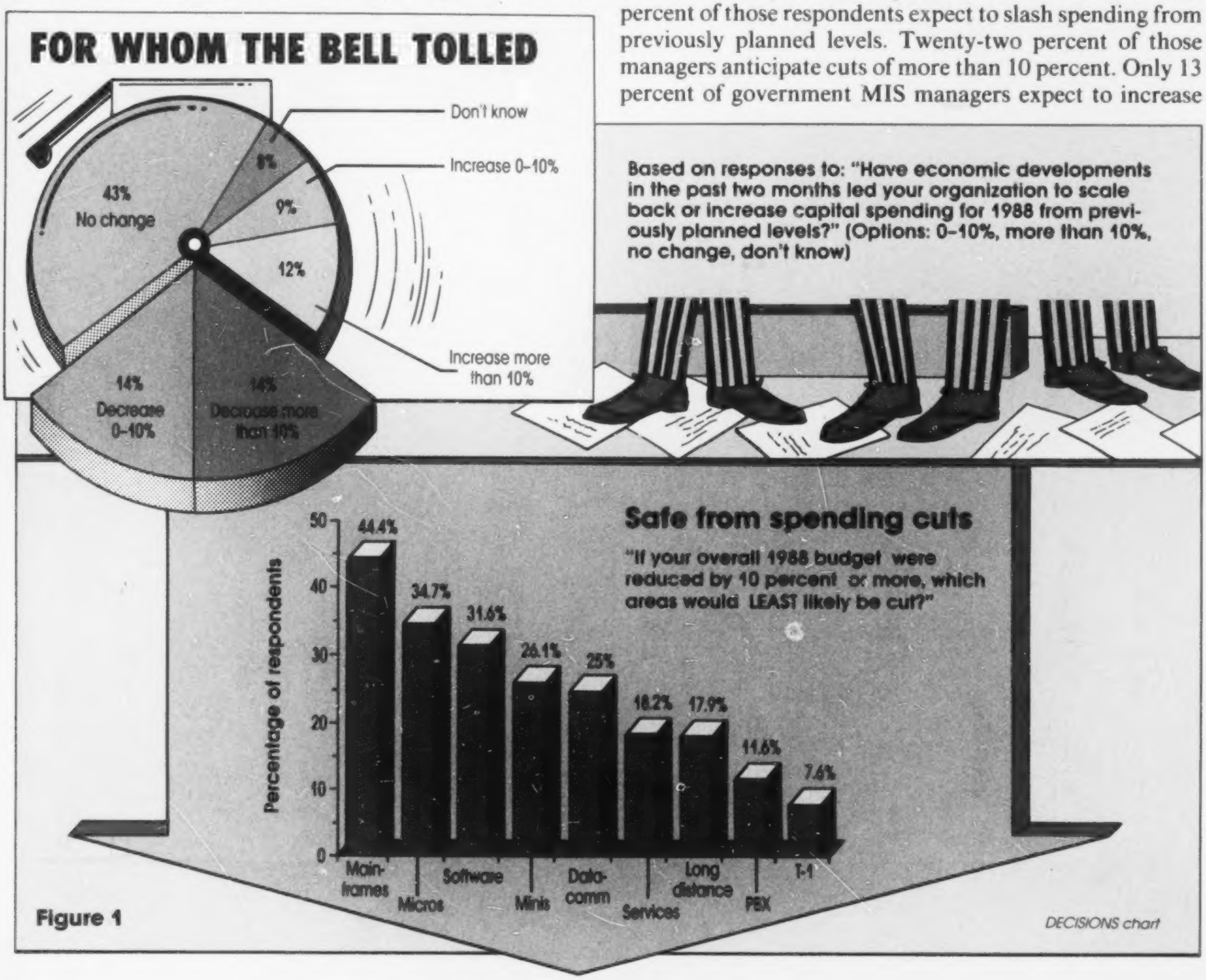


Figure 1

DECISIONS chart

Chart by Graphic Chart & Map Co & Vincent J. Gallo/DECISIONS authority for communications, he notes. Even so, when survey respondents were asked whether spending patterns would change for the major communications vendors, only Intecom and Ericsson showed drops.

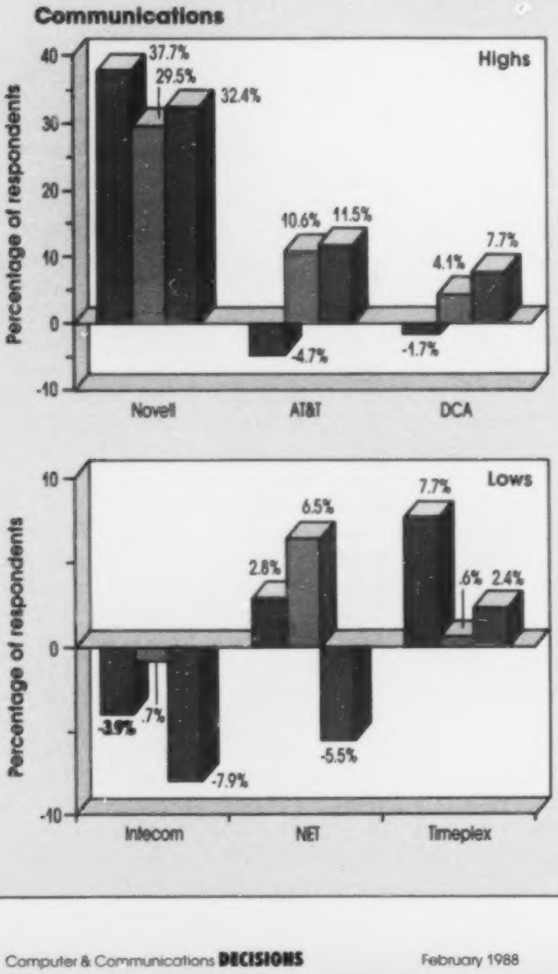
Other survey results support Smith's optimism. Capacity utilization has been growing in each of the DECISIONS/Paine Webber surveys. Sixty-eight percent of the respondents to the current questionnaire stated they are above 75 percent of their total mainframe and minicomputer capacity—the point at which Paine Webber believes users consider new purchases. Nearly 27 percent of all respondents say they are at 90 percent of capacity or above.

"That shows there's not a lot of fat in the system," says Smith, noting that excess capacity was blamed for the industry recession that began in 1985. And even though the micro segment of the market boomed in the second half of last year, hesitation to cut micro spending showed that "the micro market is not ahead of itself," as it was a couple of years ago, says Smith.

Another good sign for the industry is that about 48 percent of the respondents said they plan to increase spending on IBM—23 percent by more than 10 percent—contrasted with only 18 percent who plan to decrease spending on IBM products. The net change in spending plans on Digital Equipment Corp. equipment is even greater, as 43 percent of respondents say they will increase spending, and only 12 percent say they will decrease spending on DEC systems.

Net percentage of changed opinions is depicted. The three highest and lowest scoring hardware, software, and communications vendors on the fourth survey—plus IBM—are represented.

DECISIONS chart



Vincent J Gallo

Three other hardware vendors that might expect better years based on survey results are Apple Computer Inc., Compaq Computer Corp., and Hewlett-Packard Co. Spending on Apple equipment shows a net increase of 27 percent, Compaq an increase of 22 percent, and Hewlett-Packard 16 percent.

The boost in spending for Hewlett-Packard products is a positive sign, says Smith, and might foretell a successful launch for the vendor's Spectrum product family, based on reduced instruction set computing (RISC) technology.

The most remarkable advance, however, is that of Apple. Apple has steadily increased its standing in the Vendor Popularity Index to the point at which it now leads all hardware vendors (see chart). And the net change in spending plans for Apple products has risen to 27 percent. "What's happening with Apple is extraordinary," observes Smith. "It shows that Apple has finally become a much more important player in the MIS world." Smith credits Apple's recent introduction of the Macintosh II as the primary contributor to this trend.

On the negative side, spending on systems from Wang Laboratories Inc. can be expected to drop once again. Respondents said they will spend an average of 5 percent less on Wang equipment. Smith sees some cause for optimism, however. Respondents' opinions of Wang are not as negative as they once were. "Wang seems to have stabilized," Smith says.

Microsoft remains the most popular software vendor, with opinion in each of our surveys steadily rising to its current 37 percent rating on the index. However, some results regarding Microsoft are less favorable. When asked what would influence plans to install Operating System/2 this year, 36 percent of the respondents said they see no need for OS/2. Opinion of OS/2 was less harsh in large IBM shops. Only 21 percent of respondents who have IBM 3090s installed said OS/2 is superfluous.

Still, these results may have a higher long-term impact on IBM more than on Microsoft, because Microsoft will continue to benefit from the universal acceptance of MS-DOS. Fifty-one percent of our respondents said they expect MS-DOS to remain important this year; only 41 percent said OS/2 will be important.

From these results, it is clear that large IBM shops are more likely to migrate quickly to OS/2 than smaller ones. Robert Therrien, Paine Webber's software analyst, says he expects OS/2 to catch on slowly—despite early acceptance of the PS/2 in both our survey and the market at large. "Many people will wait for in-house applications to be developed with OS/2 before migrating to it as the standard operating system," says Therrien.

Overall, the survey augurs a healthy, if not robust, year ahead for the computer industry. Smith says a combination of these results and the fact that computer vendors have addressed many networking weaknesses leads him to feel confident about 1988. "January and February may be slow, but overall, we should see some positive growth," he predicts. "There was a fear that we were at the same point now that we were in 1985, just before the computer industry took a dive. This survey shows no evidence of that whatsoever." **D**

COMPUTER DECISIONS

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March 1988

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BEST METHODS FOR EVALUATING CASE TOOLS

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To Mark Teflian, who at United Airlines subsidiary Covia Corp. led the development of the first distributed computerized reservation system, success means keeping one step ahead of IBM.

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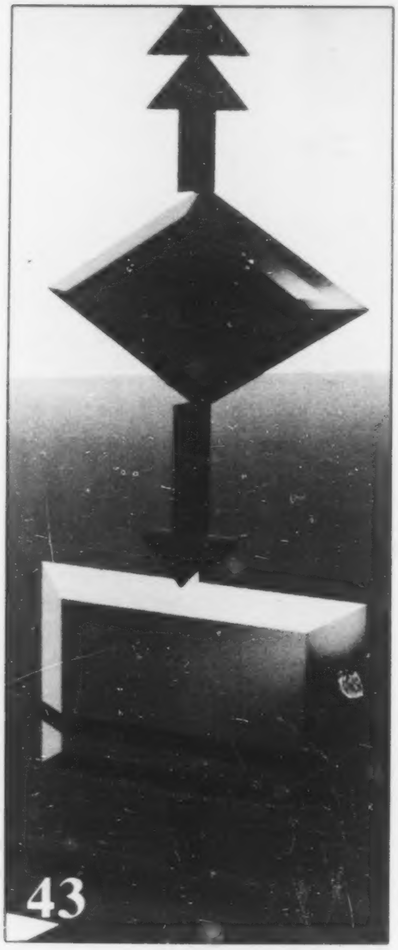

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by Miriam Lacob

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EDITOR'S MESSAGE

Technology Vs. Results

There is a split personality in this information systems game, and we all wake up every morning with it. One side says, "Get it done"; the other, "Get it done right." More often than not, the angels appear to stand with the latter.

In this issue, however, we take a look at a giant industry segment, the airlines, in which the results-oriented side has just about wiped out both the practical and aesthetic imperatives for standardization per se. The reason is simple: competition.

As Senior Editor Byron Belitsos points out, the world's largest nonmilitary database and (most likely) largest private network are products of this runaway complex. It has also produced a "war room" in which one airline alone can process 1.5 million fare changes *on a single day*. People clobbering transactions into a Xenix-based system in this kind of atmosphere aren't much concerned about when, say, a Unix standard becomes reality.

Interestingly, the airlines' rule-bending innovations in information systems bring them a higher return on investment than does the actual flying of airplanes. But in that end of the business, S.O.P. is the rule. I'm extremely happy that it is. On the same day recently, coming in and out of Austin, TX, I sat through both a missed landing approach (fog) and later an aborted takeoff (apparently nothing more than a popped circuit breaker on a warning horn). On days like that, you can only be grateful that there is a book and people professional enough to go by it.

Obviously there will be times when airline MIS managers will need to reconcile their systems to certain standards, just as there will be times when pilots have to be creative. If that weren't so, there wouldn't be much art to any enterprise. Uncle Dougal was an Army Air Corps instructor in B-25s. Once, at an airbase in west Texas, he had a suspected engine fire and declared the emergency, in strict and proper aviation syntax, while requesting a landing clearance. The tower operator, apparently half asleep, asked him to start over and repeat everything.

"One churning, one burning," Uncle Dougal barked back. "I'm coming on in."

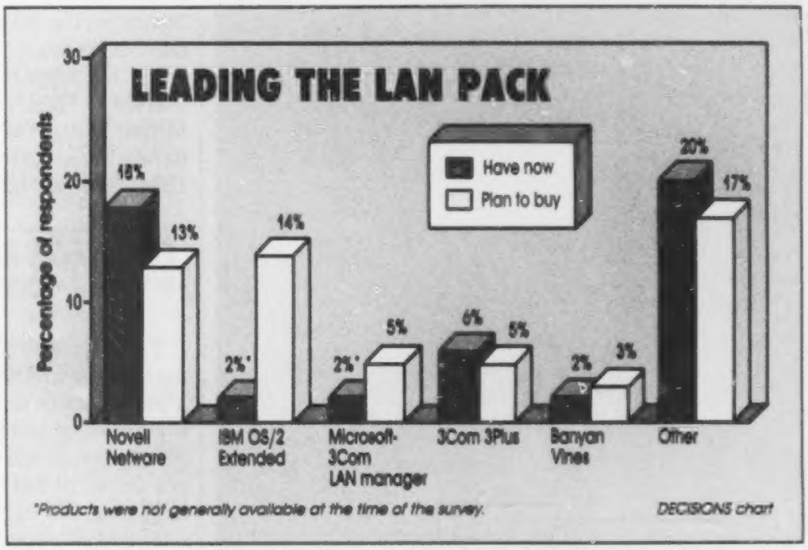
Robin Nelson

Cover Illustration:
Cheryl Griesbach/
Stanley Martucci

TECHNOLOGY TRENDS/Connectivity

IBM SHOWS LAN CLOUT

Byron Belitsos



*Products were not generally available at the time of the survey.

DECISIONS chart

Vincent J. Gallo

OS/2 Extended Edition has won over many MIS managers even before its release, according to the latest DECISIONS/Paine Webber survey.

To those who doubt IBM's mainframe marketing touch can be extended to the world of microsystems, consider the following. More respondents to the fourth DECISIONS/Paine Webber Survey of MIS Attitudes said they plan to buy an untested, unavailable LAN operating system from IBM than said they plan to buy Novell Inc.'s Netware.

The operating system, of course, is IBM's Operating System/2 Extended Edition, which, IBM says, will contain a "LAN Server" that makes it effectively a local-area network operating system. OS/2's appeal to the reader base used in the surveys—MIS managers in large corporations—has always been strong. This is IBM marketing muscle at its best: MIS has already begun lining up for a new product even though it has only been vaguely described and can't be tested by users.

The survey question that yielded this result asked, "Which of the following do you use now and/or plan to buy during the next 12 months *as your primary LAN operating system*?" The response pattern (see chart) has major implications for vendors scrambling to gain an edge in the OS/2 era. The survey data say IBM and Novell have the advantage, even over the highly publicized LAN Manager from Microsoft Corp. (Redmond, WA) and 3Com Corp. (Mountain View, CA).

Of all of IBM's competitors, Novell (Provo, UT) appears to be sitting pretty with the largest installed base of any vendor (18 percent) among respondents, and what is apparently a loyal following. Thirteen percent of respondents plan to install Netware during the next year.

By comparison, 3Com's 3Plus commanded only a 6 percent share of installations among respondents. Five percent plan to install 3Plus during next year. As for the LAN Manager, only 5 percent of respondents indicated they'd bite during the next year.

As might be expected, OS/2 Extended is more popular with respondents in IBM mainframe sites, and less popular in Digital Equipment Corp. VAX shops. The only anomaly in these data are the respondents who said they've got OS/2 Extended or LAN Manager installed. Neither was available when the survey was conducted last November. These figures can only be interpreted as reflecting erroneous, albeit overly enthusiastic, responses.

There's some irony in the fact that IBM and Novell appear to be poised to compete for OS/2 LAN operating software business. Novell officials have repeatedly declared their policy is to sail close to OS/2 Extended, as opposed to Microsoft's brand of OS/2 and LAN Manager. "We've got a very good relationship with IBM," says Darrell Miller, vice president of marketing at Novell.

Given Microsoft's cooperation on LAN Manager development with Novell's archrival 3Com, the policy is not surprising. Yet the survey results suggest that Novell will compete with IBM in LAN operating systems, not with Microsoft/3Com.

Technical realities also say Novell must compete with IBM. Vendors like 3Com and Corvus Systems (San Jose, CA) will be able to run their LAN operating systems as tasks under OS/2, allowing their packages to coexist with OS/2. Novell doesn't have that option. Netware is a protected-mode operating system, and, as such, can't run under OS/2, but only in competition with it.

Novell's strategy to ensure a place for Netware in the new OS/2 order is simple: Netware and OS/2 should run side by side, says Miller, one on a network server and the other on a file/database server. This distributed design will yield better network perfor-

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mance than configurations that put the network database and operating system in a shared server, he says.

Alternatively, Novell advocates running Netware on a coprocessor in the same server with OS/2. IBM's Micro Channel bus would facilitate this arrangement.

Both of Novell's recommendations find room for Netware beside OS/2. And Novell has taken one additional step to ensure it can play with IBM software: It announced that IBM's Logical Unit 6.2 peer-to-peer protocol will be its connectivity method. Miller believes LU 6.2 is IBM's direction with its LAN Server, and Novell intends to be compatible with that product, he says. Microsoft and 3Com, on the other hand, are advancing a competing connectivity scheme called named pipes.

LU 6.2 support will give Netware close connectivity to Netview, IBM's network management system, notes Miller. Status and alert information from Netware's own network management functions can be integrated into IBM's central Netview system. *—John Rymer*

FIVE-YEAR STUDY OFFERS NEW INSIGHT INTO NETWORK COSTS

Findings based on a five-year study of 17 IBM and DEC networking sites at 14 large corporations may help MIS get a better handle on rising network costs. The study, probably the most comprehensive of its kind, yields some surprising conclusions that may change the way MIS managers think about the expenses involved in designing, installing, and operating computer networks.

For most network managers, the way to control rising network costs is by installing new technical solutions: T-1 multiplexers, data compression, network management software, fast packet switches, and the like. So-called soft costs—personnel and organizational expenses—aren't often factored in, especially when new equipment selection is on the agenda.

When soft costs are ignored, it is at the expense of accuracy. Even sincere attempts to gauge soft costs may be stymied for lack of a rigorous, time-tested methodology with which to measure them. The result is reliance on the imperfect method of measuring the network's impact on corporate performance.

Chief among the findings of the study, which was funded by DEC, is that it can cost twice as much or more to operate a computer network than it does to install it. At the companies studied, equipment and software acquisition costs comprised about a third of total network costs during the study period; personnel expenses also accounted for nearly a third of total costs. At many sites, personnel costs (for operating and maintaining the network) were the single highest expense over the five-year span. For example, personnel and associated costs accounted for 50.5 percent of all networking expenses for the manufacturing networks studied and 29 percent of overall costs in a corporate network.

The researchers were also surprised to discover that communications costs, often a major consideration of network managers in designing and operating networks, may be of far less relative importance in the total cost picture.

MIS PILOTS THE AIR WARS

Major airlines are putting MIS at the fore of a white-hot competition with billion-dollar stakes. The second entry in our 'MIS in transition' series.

by Byron Belitsos

The airline industry, more than any other business sector, illustrates the increasing importance of information systems in gaining a competitive edge. Air transportation today is a commodity service. The window on flight information provided by the travel agency workstation is now the strategic factor in competition among the airlines.

The airline that captures the travel agency desktop controls both the agent's and the passenger's gateway to information about its services and those of its competitors. That control is crucial: Of the nearly 40,000 travel agencies in the United States, 90 percent are automated. The airline that provides an agency's computerized reservation system (CRS) is up to 30 percent more likely to gain bookings on its flights, studies show.

MIS holds the keys to both capturing and maintaining that customer relationship, first by locking the travel agent into its CRS network, then by offering improvements in the travel agent's user interface and integrating office automation applications on the same workstation. MIS must also provide a network architecture underpinning increasingly advanced applications to improve the travel agent's productivity. With the widespread introduction of the IBM Personal System/2 and Token-Ring local-area network into reservation systems, as well as United Airlines' recent unveiling of a distributed CRS architecture, competition in the air wars promises to be hotter than ever.

The race to build proprietary CRSs began in 1975, after representatives from the major airlines and travel agencies met to consider establishing an industrywide computerized reservation system. A few months after that meeting, United Airlines and American Airlines pulled out of the industry organization just a day apart. The race was on to offer travel agents proprietary systems.

MIS then came to the fore. At the time, only a minority of the nation's 12,000 travel agencies then in existence were expected to request direct links to CRSs, then used only internally by the airlines. United Airlines made the first move, introducing its Apollo system in a few select agencies. However, Max Hopper, then a data processing manager and now senior vice president of MIS at American Airlines, led an aggressive development and marketing effort for the airline's SABRE (Semi-Automatic Business-Related Environment) system.

SABRE quickly captured 90 of the top 100 travel agencies, leaving Apollo far behind. Although TWA introduced its Programmed Airline Reservation System (PARS) soon after the leaders, late in 1976, it trailed a distant third. American had won the crucial early battle of the reservation wars.

Other battles followed. In 1978 deregulation set off an information explosion, and the airlines scrambled to gear up their reservation systems to cope. Previously, alternative fares and flying schedules had been few, and fares changed only a few times a year. "Deregulation, especially with discount fares and the proliferation of new carriers and added routes, caused fares to change at

AMERICAN AIRLINES

Courtesy American Airlines

AA The origination of proprietary computerized reservation systems can perhaps be traced to a conversation in 1975 between Max Hopper (left), senior vice president of MIS, with Robert Crandall, then finance vice president and now chairman of AMR Corp., American's parent. Their discussion followed a meeting of the major players to consider a joint CRS. "This is the coming distribution system," Hopper recalls saying. "Giving it to someone else is not in our best interest."

Andrea Baruffi

phenomenal rates," says Bill Jewell, director of communications engineering at American Airlines.

Today, American has a group of more than 70 pricing analysts, programmers, and operations researchers dedicated to setting the fares most likely to give it an edge in the reservation wars. The group performs what it calls yield management, calculating a flight's optimal revenue yield per seat. Those calculations are done with Dinamo, a sophisticated in-house program that runs on an IBM 3000 series processor.

Among the most important factors in Dinamo's calculations are the fares offered by other airlines on that same flight segment. "Since competitors are constantly changing fares to gain a competitive edge as the actual flight time approaches, our fares for the same segment must fluctuate accordingly," explains Joe Selman, an American spokesman. "During routine times, we have to load 200,000 new fares a day. In a fare war, this figure approaches 1.5 million."

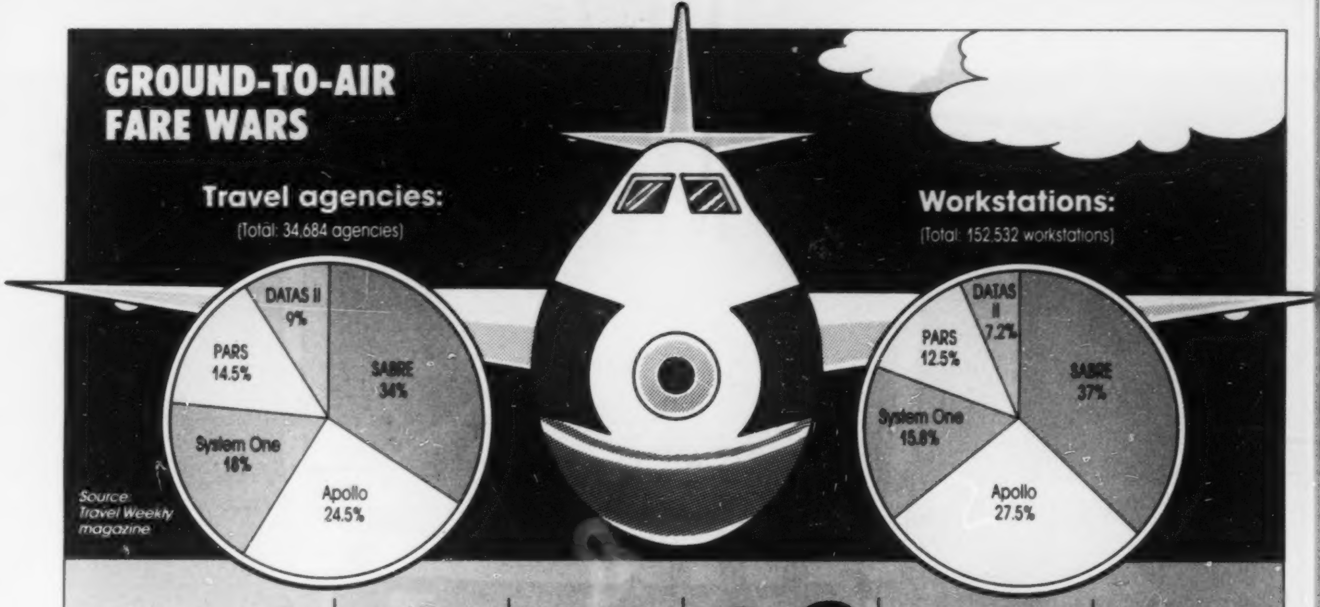
As a result of deregulation, any one transaction with a CRS's centralized databases became far more complex. "To process a typical transaction in a system with a two-second standard response time used to consume about 5,000 [computer] instructions," says Mark Teflian, vice president of technical planning and systems engineering at Covia Corp., United Airlines' information processing subsidiary, established in 1986. "Now, each transaction uses up to a million instructions. At peak times, because of the exploding number of agency CRTs on the network, we handle over 1,400 transactions per second."

Delta Airlines entered the reservation wars last, in 1982, with its DATAS II system. DATAS II was upgraded in early 1987 with the introduction of the Deltastar system. Texas Air also became a major player when it acquired Eastern Airlines in 1986. By buying Eastern, Texas Air gained control of Eastern's System One CRS, introduced in 1981.

Last year's introduction by United of its distributed architecture upgrade to Apollo confirmed a major trend: Computerized reservation systems are the core marketing strategy of the five major airlines. "All the big airlines except TWA introduced new versions of their reservation systems last year," says Nadine Godwin, automation editor of *Travel Weekly*, the leading airline industry trade journal. "It was the biggest new product year ever for both hardware and software."

Little wonder. Per dollar spent, the airlines now make more money on their reservation systems than they do flying passengers. According to Edward Stackman, an airlines analyst at Wall Street brokerage Paine Webber Inc., in a good quarter the airlines have an 8 percent to 10 percent profit margin overall, while CRSs make as much as 20 percent profit. In 1984, SABRE netted American a 40 percent profit. "The last thing you want to do with an airline is fly airplanes," quips Peter Keen, an information technology strategy consultant and president of the International Center for Information Technologies (Washington).

The current stage of the reservation wars involves the introduction of personal computers into travel agencies. All the airlines—with the exception of TWA—are now trying to convince



Airline	American Airlines	United Airlines Corp.	Texas Air Corp.*	TWA/Northwest Airlines	Delta Airlines Inc.
CRS provider	AMR Information Services Inc. (Dallas)	Covia Corp. (Rosemont, IL)	System One Corp. (Houston)	PARS Travel Information Systems (Kansas City, MO)	Delta Airlines Inc. (Atlanta)
CRS	SABRE	Apollo	System One	PARS	DATAS II
Revenues (in millions)	$490	$325	$210	[illegible]	[illegible]
Profits (in millions)	$190	$125	$50	$40	$20

*Holding co. for Eastern and Continental Airlines.

Source: Air Transport Association/Simat, Helliesen & Eichner Inc.

Chart by Chart & Map Co. & Vincent J. Gallo/DECISIONS

The airlines' battle for travel agency territory is a crucial one. The CRS vendor who provides an agent's system is one-third more likely to gain bookings on its own flights, studies show.

agents to upgrade from dumb terminals to IBM Personal System/2s and Operating System/2, allowing data and applications to be offloaded from central mainframes.

"The PS/2 gives us the freedom to do a lot of things with the user interface that weren't possible before," says Terrell Jones, vice president of product development at AMR Information Services, American Airlines' information processing subsidiary. "When you run a host system with 60,000 terminals and two- or three-second response time, you can't offer easy-to-use, fill-in color screens."

Delta was first to announce a PS/2-based CRS, early last year. Delta has installed 1,200 Model 30 PS/2s in the last three months, and is expecting to continue installing them at that pace.

With PARS, TWA has offered microcomputer-like functionality to agencies since 1985, when it introduced the Office Management System (OMS), the industry's first integrated travel/business automation system. OMS set the standard for the PS/2-based applications the four rival carriers are now unveiling. OMS hardware includes dumb terminals in a multiuser configuration based on an Altos 1086 or 2086 processor running under the Xenix operating system.

According to Martha Valkind, vice president of product planning at PARS Travel Information Systems, TWA is now considering upgrading to Intel 80386-based micros, Xenix V.3, and color terminals. She's not convinced that the other carriers will gain an edge with PS/2-based systems. "Of course, we are going to look at OS/2," she says. "But to date we don't think the IBM product line is really out there."

Delta, United, and American plan to link travel agency PS/2s via IBM Token-Ring LANs to integrate back-room travel agency management applications with reservations processing, much like PARS's OMS. The PS/2s on the agency LANs American and United will be offering are diskless systems—American will offer Models 30 and 50, United the Model 50 only—tied to a Model 60 acting as a local file server. An additional Model 50 will act as a dedicated intelligent gateway for communications with mainframes.

For booking reservations, all the CRSs offer an improved user interface with some variation of a multicolored, menu-driven screen that simplifies fare calls to central mainframes. Fill-in screens will streamline the training of new agents. Previously, new agents had to learn hundreds of complex encrypted codes based on an industry-standard reservation message format to build each Passenger Name Record, the basic data that comprise an airline booking. With the upgraded systems, English-language entries or macro programs can be used instead.

The more sophisticated new applications the carriers are offering include the ability to build individual or corporate customer profiles that can be automatically merged with the Passenger Name Record whenever new bookings are made. Similar packages aimed at large corporate travel departments direct agents to select the fares, airlines, hotels, and other travel and entertainment elements that match corporate travel policy parameters. American's new Capture package, for instance, not only enforces corporate travel policies but also simplifies the travel and entertainment expense reporting process by capturing all travel spending information and building a consolidated expense report.

UNITED AIRLINES

Will Covia's new distributed version of its Apollo CRS give it the boost it needs to catch up to American's front-running SABRE system? Barry Kotar, president of Covia, thinks so. "SABRE can't support a distributed environment, and American doesn't have a plan for the equivalent of Open Systems Manager," he says. "It hasn't thought through the issue of developing software for distributed applications. We've spent two and a half years developing this environment."

As of January, American had placed PS/2s in over 300 travel agency locations. "We're using PS/2s not only to expand our user interface into the mainframe database, but also to capitalize on all the software available for the PS/2 platform," explains Jones. For example, American just introduced SABRE Works, an adaptation of Microsoft Corp.'s Microsoft Works for use in travel agencies. Like the OMS package developed for PARS, SABRE Works allows agents to use the same machine to move between reservations functions and word processing, spreadsheet, and database applications.

The rules of the reservation wars are changing again with Covia's upgrade to the Apollo CRS. The new version of Apollo is the industry's first fully distributed transaction processing system.

Barry Kotar, president of Covia, calls the new distributed system a "third-generation" reservation system. The first-generation network architecture was based on a single, unshareable mainframe database used internally by the airlines, Kotar explains. The second generation included multiple mainframes and a shared database, using IBM's TPF (Transaction Processing Facility) operating system.

Based on the new distributed architecture, Covia's new Focalpoint product line for agencies offers the most advanced functionality of any of the new CRS offerings. Focalpoint, which took two and a half years to develop, allows sophisticated PS/2-to-host communications and intelligent cooperative processing via IBM's Logical Unit 6.2 protocol. Apollo's new Open Systems Manager communications software, developed to support fully distributed applications and database distribution across the network, allows location-independent processing. Subsets of OSM may reside in computers at all three levels of the architecture hierarchy: in TPF-based hosts or other hosts, in regional processors, such as airport systems, or in desktop workstations. Focalpoint also includes a graphics-oriented, multitasking user shell based on Microsoft's Windows.

United plans to exploit Microsoft's OS/2 and any extensions IBM adds to it. According to Rick Pemberton, senior technical support design analyst at Covia, one of United's first applications of OS/2 will be to use its multitasking capability to combine file server and gateway functions on one PS/2.

The travel agent's interface is radically changed by the combination of Focalpoint's Scriptwriter feature and Microsoft Windows. Using Windows, up to four online network transactions can be displayed on the same screen. Scriptwriter also guides agents by providing simple prompts that require English-language entries. The new format will save agents up to three-quarters the normal number of keystrokes on Apollo.

Scriptwriter makes windowing simple, says Pemberton. With one request, an agent can automatically display fare quotes from up to four airlines, or bring up windows concurrently to show such information as a flight's seat availability, a personal or corporate profile, and the fare quote. In the past, such information was handled by agents in separate steps and in successive screen displays.

TEXAS AIR

Texas Air, the holding company of Eastern Airlines and Continental Airlines, currently ranks as the largest carrier in the country. Texas Air may have entered the reservation wars late, but it's risen to the number-three slot with its System One CRS. Key to its success: its travel agency conversion tactics, which include defending defecting agencies in any lawsuits brought against them by their original CRS suppliers. System One is headed by Bill Murray (pictured).

United turned to the new architecture because of the harsh lessons the company learned playing catch-up to American's SABRE. As travel agency demands for automation exploded in the 1970s, United sometimes had to postpone adding new terminals to its network while it upgraded its host facilities. "We had to physically replace all the hardware at the Apollo central site every two years," says Kotar. "We were always dependent on IBM or some other vendor to give us the next biggest piece of hardware or some advance in storage technology that would give us the needed capacity. We were continually up against a wall."

At that point, United's MIS organization began evaluating alternatives for a new architecture. Several years of planning led to a choice of a distributed architecture based on IBM's Systems Network Architecture/Synchronous Data Link Control (SNA/SDLC). "We adopted SNA for our back-

For airlines in the reservation wars, spending hundreds of millions on systems is not enough.

bone architecture even though back in 1981 the limitations of SNA were significantly greater than they are today," says Kotar. "We decided to take advantage of existing products and concepts where possible, including IBM's Personal Computers and token-ring networking, plus products from other vendors, such as Microsoft."

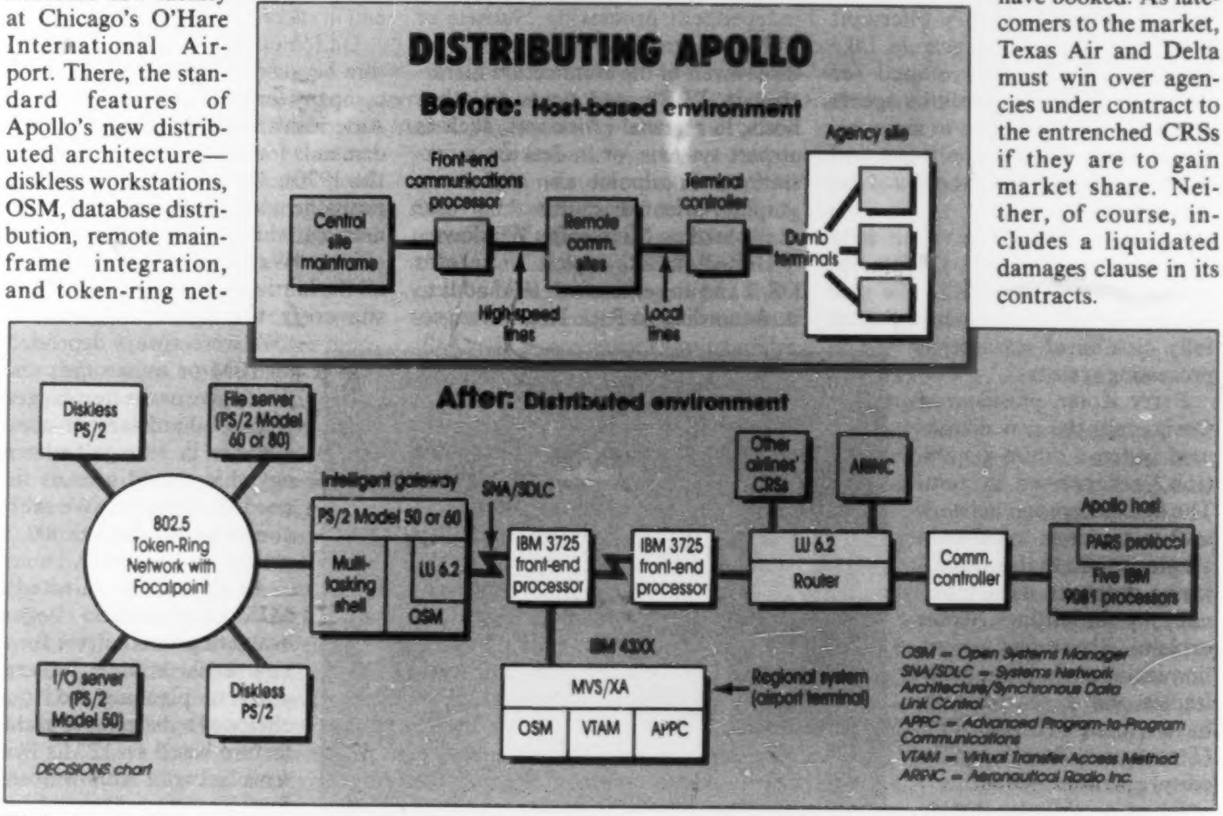
Writing software to integrate these elements led to the creation of a proprietary distributed transaction processing solution—primarily the OSM communications software—that United's Mark Teflian believes "has had and will have an impact on IBM's further development of Systems Application Architecture. We've basically developed a way to tie together different IBM operating systems through LU 6.2," he says.

To date, the biggest implementation of the new architecture is United's "Terminal for Tomorrow," its immense new facility at Chicago's O'Hare International Airport. There, the standard features of Apollo's new distributed architecture—diskless workstations, OSM, database distribution, remote mainframe integration, and token-ring network management—comprise the world's largest token-ring LAN, encompassing four token-ring backbones and 23 smaller token-ring nets able to handle a half million remote and local transactions daily. The network includes 130 workstations plus 150 other devices acting as gateways, file servers, and input/output servers. The network is managed through an adaptation of IBM's Netview.

United's distributed architecture may eventually give it an edge on SABRE in the reservation wars. But for now, American Airlines' system dominates the reservations market. SABRE's network includes nearly a million miles of data circuits and holds the schedules of 650 airlines—some 30 million fares—and information on 16,000 hotels and 33 car rental agencies, among many other elements. With 550 gigabytes of online storage, SABRE is the largest nonmilitary database in the world and is likely the world's largest private network.

Nevertheless, in the reservation wars, spending hundreds of millions on state-of-the-art systems is not enough. The big CRS providers guard their hard-won territories jealously, spending nearly equivalent amounts backing their networks with elaborate lawsuits against one another.

These lawsuits result from the tough tactics used by the entrenched CRS providers—American, United, and TWA—to keep agents on their networks. Generally, when an agency seeks release from a contract with one airline to convert to a rival's CRS, it must pay the airline for the cost of removing the equipment and for the lost equipment rental fees. In addition, these contracts, which typically run for five years, contain "liquidation damages" clauses that make agencies responsible for the estimated value of the offline booking fees from rival carriers whose passengers they would have booked. As latecomers to the market, Texas Air and Delta must win over agencies under contract to the entrenched CRSs if they are to gain market share. Neither, of course, includes a liquidated damages clause in its contracts.


DISTRIBUTING APOLLO
Before: Host-based environment
Agency site
Front-end communications processor
Terminal controller
Central site mainframe
Remote comm. sites
Dumb terminals
High-speed lines
Local lines
After: Distributed environment
Diskless PS/2
File server (PS/2 Model 60 or 80)
802.5 Token-Ring Network with Focalpoint
I/O server (PS/2 Model 50)
Diskless PS/2
Intelligent gateway
PS/2 Model 50 or 60
Multi-tasking shell
LU 6.2
OSM
SNA/SDLC
IBM 3725 front-end processor
IBM 3725 front-end processor
Other airlines' CRSs
ARINC
LU 6.2
Router
Comm. controller
Apollo host
PARS protocol
Five IBM 9081 processors
IBM 43XX
MVS/XA
OSM
VTAM
APPC
Regional system (airport terminal)
OSM = Open Systems Manager
SNA/SDLC = Systems Network Architecture/Synchronous Data Link Control
APPC = Advanced Program-to-Program Communications
VTAM = Virtual Transfer Access Method
ARINC = Aeronautical Radio Inc.
DECISIONS chart
Vincent J Gallo

With the recent upgrade of its Apollo computerized reservation system, United became the first airline to offer a distributed CRS. A key component of the system is the Focalpoint software family.

The cost of terminating a CRS contract in a large agency can run into millions, says Donald Sohn, president of Heritage Travel Inc., a Cambridge, MA, travel agency. A major reason agencies undergo the trauma of changing CRSs before a contract ends is market geography. Agencies may want to change if a new airline becomes the major carrier in its area.

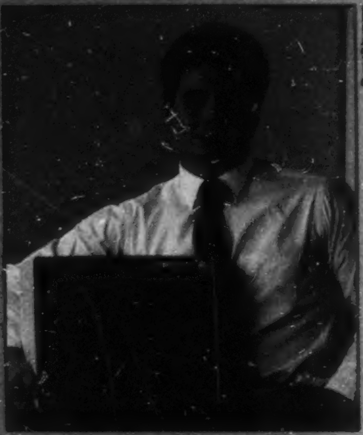
Texas Air adds the incentive of defending agencies that switch to System One in lawsuits brought by the carrier whose contract is being broken. Last year Texas Air increased its travel agency market share to 18 percent, up 3 percent from 1986.

An innovation called Direct Access is probably System One's strongest selling point for agencies using rival CRSs, according to Nadine Godwin. First introduced by Eastern Airlines in 1981, Direct Access allows users to bypass ARINC (Aeronautical Radio Inc.), a corporation set up by the airline industry in the 1970s for switching messages and inquiries to and from each airline's database. With Direct Access, agents can make and confirm reservations directly from the inventories of other carriers. Although the feature has been replicated by the other carriers, System One offers the most complete system, with direct access to the databases of 23 carriers.

System One recently upstaged SABRE when its software was chosen by Amadeus, a consortium of four European airlines (Air France, Lufthansa, SAS, and Iberia), as the core of its proposed European CRS. One reason cited for the choice was Direct Access. U.S. CRS providers are keeping a close watch on European opportunities, another potential battleground. Covia won a contract to transfer major features of Apollo to a second European consortium, Galileo, which includes British Airways, KLM, and Swiss Air.

But the ultimate battle in the reservation wars is being waged between American Airlines and United Airlines. Says Covia's Mark Teflian, "With transactions and services growing—and they must proliferate to compete today—there is going to be a critical mass someday for all of us in terms of level and the number of applications that we are all planning on our networks. The platform provided by our distributed architecture will get us through that, resulting in a clear leadership position." **D**

INNOVATION ARCHITECT



When it comes to IBM, Covia Corp. is a leader, not a follower, says Mark Teflian.

Covia Corp., a United Airlines subsidiary, scored a competitive coup in the air wars last year when it introduced a distributed upgrade of its Apollo computerized reservation system, making Apollo the first distributed CRS. Mark Teflian, vice president of technical planning and engineering, led the development of this systems breakthrough.

In Teflian's view, the importance of the new system centers on its Open Systems Manager communications software. "OSM is a common set of communications, user interface, data, and application services that are homogeneous to all the different computing systems on our network," Teflian says. "Offering truly distributed applications means that services and functions for those applications have to be available at any point in the network."

OSM gives Covia a high degree of flexibility in managing Apollo, Teflian says. "OSM enables us to locate an application in one node on the network one day or move it to another one at another time when that's necessary," he observes.

A single consistent user interface to data and services is key, Teflian says. As an example, he cites Travelscreen Plus, a part of Apollo's new Focalpoint product family. "Part of Travelscreen's functionality is located in the local file server, and part in the central site," he says. "A travel agent with multiple branch offices can store an important customer's corporate profile on a central mainframe. Otherwise, the agency would need multiple copies of the disks for that same customer at each of its branch locations."

Teflian points out parallels between Covia's development of its distributed architecture and IBM's development of Systems Applications Architecture. "In 1983, when we decided to distribute Apollo's services, we assessed what functionality would be needed in our operating systems at the various network levels to provide application-independent processing, access to the data, and a common user interface," he says. "We used the architectural models available to us at that time—primarily higher-level SNA services like DIA/DCA [Document Interchange Architecture/Document Content Architecture], SNADS [SNA Distribution Services], and LU 6.2. For those services not available in our operating systems, whether they were in TPF, MVS, DOS, or Unix, we developed a common architectural model and set of services that we put into the distributed complex. This gave us the same level of services that IBM is now defining as SAA—the ability to allow cross-systems transparency in a distributed network."

Teflian adds, however, that IBM did not participate in or influence the development of OSM. If anything, he sees it the other way around. "Our development of OSM has had and will have an impact on IBM's further development of SAA," he says.

Covia will continue to track SAA's progress closely, Teflian concludes. "As our systems grow, we plan to adopt more of the embedded functionality that IBM and other vendors will provide. At the same time, we're not going to wait around. We're going to proceed with our products and structure them to take advantage of those advanced architectures when they come about."

PERFORMANCE REPORT

MICRO INDUSTRY: SAFETY IN NUMBERS

Contrary to the predictions of some pundits, the micro business is still booming. The numbers tell the tale.

by Patrick Flanagan

The microcomputer market continues to grow at a blazing rate, to the surprise of some and to the profit of many—the many being the micro industry's leaders.

IBM's introduction last April of its Personal System/2 line did much to keep the fire in the micro market raging. By the end of last September, IBM had shipped more than a million PS/2s. Microsoft Corp. began delivering Operating System/2, the long-awaited next-generation micro operating system, in December. The arrival of PS/2 and OS/2 didn't mean a hasty exit for MS-DOS machines, however; sales of those micros held steady. Meanwhile, laser printers got cheaper and better, triggering hardware and software upgrades.

The 1988 DECISIONS Performance Report on the micro industry focuses on those companies for which micro-related products constitute the largest revenue-producing segment of their dp business, and is based on financial results for the 12 months ending September 30, 1987. The report does not reflect the impact of the October stock market plunge, but early financial data from some major vendors in the micro arena suggest that the crash had minimal impact on the industry. Apple Computer Inc., for example, continued its upward surge, posting fourth-quarter earnings of $121.4 million, more than double its earnings for the comparable period in 1986. Compaq Computer Corp. broke the $1 billion mark in annual sales and tripled its fourth-quarter earnings of a year earlier, posting $49 million in net profit for the quarter.

For the period October 1986 to September 1987, the 12 leading vendors in each of the three micro categories—systems, software, and peripherals—averaged revenue growth of 47.3 percent, 54.4 percent, and 21.2 percent, respectively. Average revenue growth of these 36 vendors was an impressive 41.9 percent, as their combined revenues exceeded the hefty $11 billion mark. And that revenue total doesn't include micro-related sales from large-systems vendors, including IBM, or original equipment manufacturer sales.

IMS America Ltd., a Plymouth Meeting, PA-based research firm, reports that

Computers

Courtesy of Tandon

Tandon CEO S.L. Tandon

Tandon saw 1987 sales soar 119 percent.

'87	'86	Computer company	'87 Revenues (000)	'86 Revenues (000)	Percent Growth	Total '87 Revenues (000)	Total '87 Profits (000)
1	1	Apple Computer Inc. *(Cupertino, CA)*	**2,661,068**	1,901,898	40	2,661,068	217,496
2	2	Tandy Corp. *(Fort Worth, TX)*	**1,667,491**	1,557,587	7	3,547,854	262,864
3	4	Zenith Electronics Corp. *(Glenview, IL)*	**1,000,000*(E)**	548,000*	82	2,300,000	N/A
4	3	Compaq Computer Corp. *(Houston)*	**978,825**	594,621	65	978,825	103,500
5	—	Leading Edge Products Inc. *(Canton, MA)*	**400,000**	N/A	N/A	400,000	N/A
6	5	NEC Information Systems Inc. *(Boxborough, MA)*	**340,000**	218,000	56	340,000	N/A
7	6	Tandon Corp. *(Chatsworth, CA)*	**201,180**	92,054	119	335,300	12,674
8	9	Dell Computer Corp. (PC's Ltd.) *(Austin, TX)*	**150,000(E)**	69,450	116	150,000	N/A
9	7	Telxon Corp. *(Akron, OH)*	**108,360**	91,947	18	108.360	13,232
10	8	Kaypro Corp. *(Solana Beach, CA)*	**105,606**	77,925	36	105,606	(9,597)
11	10	Grid Systems Inc. *(Fremont, CA)*	**60,000**	56,600	6	60,000	N/A
12	14	Iverson Technology Corp. *(McLean, VA)*	**33,101**	21,459	54	33,101	3,478
		Total	**7,705,631**	5,229,541	47.3		

*Calendar year
(E)=Estimated
Unless otherwise noted, annual revenues are based on the four fiscal quarters ending on or near September 30, 1987.

'87	'86	Software company	'87 Revenues (000)	'86 Revenues (000)	Percent Growth	Total '87 Revenues (000)	Total '87 Profits (000)
1	2	Microsoft Corp. *(Redmond, WA)*	**381,746**	229,141	67	381,746	77,313
2	1	Lotus Development Corp. *(Cambridge, MA)*	**361,799**	272,872	33	361,799	64,699
3	3	Ashton-Tate *(Torrance, CA)*	**244,425**	160,259	53	244,425	37,739
4	4	Wordperfect Corp. *(Orem, UT)*	**100,300***	52,239*	92	100,300	N/A
5	6	Autodesk Inc. *(Sausalito, CA)*	**65,253**	40,903	60	65,253	15,176
6	9	Borland International *(Scotts Valley, CA)*	**50,000*(E)**	29,200*	71	50,000	N/A
7	5	Softech Inc. *(Waltham, MA)*	**42,664**	46,319	-8	42,664	769
8	7	Micropro International Corp. *(San Rafael, CA)*	**41,332**	38,230	8	41,332	2,906
9	10	Software Publishing Corp. *(Mountain View, CA)*	**38,576**	23,662	63	38,576	5,193
10	11	The Santa Cruz Operation Inc. *(Santa Cruz, CA)*	**36,600***	17,100*	114	36,600	N/A
11	—	Aldus Corp. *(Seattle)*	**30,910**	N/A	N/A	30,910	2,177
12	16	Adobe Systems Inc. *(Palo Alto, CA)*	**30,688**	12,774	140	30,688	6,861
		Total	**1,424,293**	922,699	54.4		

**Calendar year*
(E)=Estimated
Unless otherwise noted, annual revenues are based on the four fiscal quarters ending on or near September 30, 1987.

Software

Cindy Charles

John E. Warnock of Adobe

No one has succeeded in cloning Postscript yet.

total sales of micros through computer dealers for the 12 months ending last November 30 reached $2.4 billion for 1.6 million units, up from $1.4 billion for 1.2 million units a year earlier. Although IMS reports on sales by computer dealers only, its data are significant because IMS actually audits dealer invoices, rather than rely on estimates from financial analysts.

The gain reported by IMS is particularly impressive considering that the average price paid for a micro rose to $1,500 from $1,167 the year before. The research firm concludes that the higher per-unit prices for micros are an indication that sales of low-end clones are slipping. Lap-tops contributed greatly to the market's growth, going from $23.6 million to $114 million in one year's time. IMS also reports no appreciable slowing of sales in November, the month after the stock market slide.

The microcomputer printer market—particularly the laser printer segment—also boomed, according to IMS data. Dealer sales of all types of printers were up by 34 percent, to $865 million. Dealer sales of laser printers went from 75,800 units to 144,300 units; that total represents a market share of 34 percent, up from 31 percent in the previous period. To the surprise of few, the gain in market share by laser printers came at the expense of daisy-wheel printers, which dropped from 6 percent to 3 percent of the market.

PS/2 stokes the fires

Most industry analysts agree that IBM's PS/2 was the most significant factor in keeping the micro business going strong. Apple pitched in too, scoring well with the Apple IIG and Macintosh SE machines. Compaq, Tandon Corp., and Zenith Electronics Corp. also showed strong results from sales of micros based on Intel 80286 and 80386 processors.

In recent years, the underlying strength of the micro market has been sales of IBM Personal Computer XT and PC AT clones. Will these commodity machines fade as IBM imposes a new standard based on the PS/2's Micro Channel bus architecture? "IBM is shattering the homogeneity of the micro business," observes John C. McCarthy of Forrester Research Inc., a Cambridge, MA, consultancy. He expects to see three tiers of microcomputer suppliers in the near future: those offering PC XT and PC AT clones in the $500 to $1,000 range; low-end Micro Channel suppliers serving mainstream users in medium to large companies; and vendors of high-performance Micro Channel systems for advanced applications, such as computer-aided design and manufacturing and number crunching based on mainframe database access.

There are still those who claim that the PS/2 and Micro Channel are overrated, but that's a message falling on deaf ears in the corporate computing world. The fourth DECISIONS/Paine Webber Survey of MIS Attitudes, results of which were processed in early December, shows that 41 percent of respondents believe OS/2 is important to information systems planning this year, 32 percent feel the same about multiuser micros, and 13 percent favor Micro Channel (see accompanying chart, page 48). In a Forrester Research survey of large corporations conducted in January, 85 percent of the respondents said they plan to standardize on PS/2s running under OS/2 this year.

One thing is certain: The Micro Channel market will not be conceded to IBM. What's holding the clone makers back at present is IBM's patents on key Micro Channel features, combined with a great

'87	'86	Peripherals company	'87 Revenues (000)	'86 Revenues (000)	Percent Growth	Total '87 Revenues (000)	Total '87 Profits (000)
1	1	Epson America Inc. *(Torrance, CA)*	**520,000*(E)**	500,000*(E)	4	N/A	N/A
2	2	Brother International Corp. *(Piscataway, NJ)*	**412,000***	397,000*	4	1,030,000	N/A
3	3	AST Research Inc. *(Irvine, CA)*	**244,327**	168,842	45	244,327	9,958
4	4	Intelligent Systems, Master LP. *(Norcross, GA)*	**160,106**	130,229	23	160,106	12,104
5	11	Everex Systems Inc. *(Fremont, CA)*	**157,475**	63,327	149	157,475	8,625
6	7	Quantum Corp. *(Milpitas, CA)*	**155,504**	113,082	38	155,504	4,157
7	9	Genicom Corp. *(Waynesboro, VA)*	**151,959**	86,236	76	257,557	9,692
8	6	Printronix Inc. *(Irvine, CA)*	**120,026**	127,692	-6	120,026	(6,407)
9	10	QMS Inc. *(Mobile, AL)*	**119,399**	73,633	62	119,399	8,671
10	13	CMS Enhancements Inc. *(Costa Mesa, CA)*	**118,717**	50,538	135	118,717	2,010
11	8	Emulex Corp. *(Costa Mesa, CA)*	**107,583**	105,544	2	107,583	3,525
12	5	Iomega Corp. *(Roy, UT)*	**90,936**	128,774	-29	90,936	(38,682)
		Total	**2,358,032**	1,944,897	21.2		

*Calendar year
(E)=Estimated
Unless otherwise noted, annual revenues are based on the four fiscal quarters ending on or near September 30, 1987.

deal of saber rattling from Big Blue. The major barriers to bringing PS/2 clones to market may have already fallen, however. Chips and Technologies Inc. (San Jose, CA) announced in January that it had developed a set of chips that emulate Micro Channel's functions. With the chip set, PS/2 clones could be in the market by midyear. Gerome Campbell, president of Chips and Technologies, is discussing a licensing agreement with IBM, but says, "We have no clear resolution." Two other companies, Adaptec Inc. (Milpitas, CA) and Phoenix Technologies (Norwood, MA), have developed the necessary disk controller and basic input/output system for PS/2 clones.

A number of analysts contend that some clone makers won't wait for a resolution of the tedious licensing negotiations with IBM. Observers disagree on whether IBM will take legal action against competitors that bring PS/2 clones to market. "Clone bashing in the Far East is acceptable, but IBM might not be eager for antitrust reasons to attack American manufacturers," ventures John McCarthy of Forrester. "For now, it's relying on a strategy of fear, uncertainty, and doubt through what it says to the press. When the first Micro Channel clone appears, it will legitimize the new IBM PS/2 technology by providing alternative sources. This is important to IBM."

Tim Bajarin of Creative Strategies, a Santa Clara, CA, consultancy, doesn't think clone makers will go unchallenged by IBM. "The first PS/2 clone vendor in the market will probably get hit with a suit to slow down the others as IBM builds PS/2 market share," he speculates. Bajarin agrees, however, that Micro Channel cloning is inevitable and that it will build acceptance of PS/2 machines.

Just who will be first in bringing out a PS/2 clone is unclear. Compaq, Zenith, PC's Limited (Dell Computer Corp.), and Wyse Technology (San Jose, CA) are prime candidates because each has the engineering staff to pull it off. The Japanese and South Korean manufacturers aren't talking. Neither are most of the other clone makers.

One vendor that will take its time in readying a PS/2 clone is Tandon Corp. Although Tandon's impressive 1987 results came in large part from European sales, in the U.S., demand for 80386 machines continued to exceed supply. "If the PS/2 becomes the standard, we will move into the market," says Ranjit Sitlani, executive vice president. He says that for the rest of the year or even longer, the Tandon 286- and 386-based machines can compete with the PS/2. Sitlani says questions about OS/2 are contributing to Tandon's wait-and-see attitude. "We want to see how fast OS/2 products are developed and how well they work," he says.

The quiet revolution

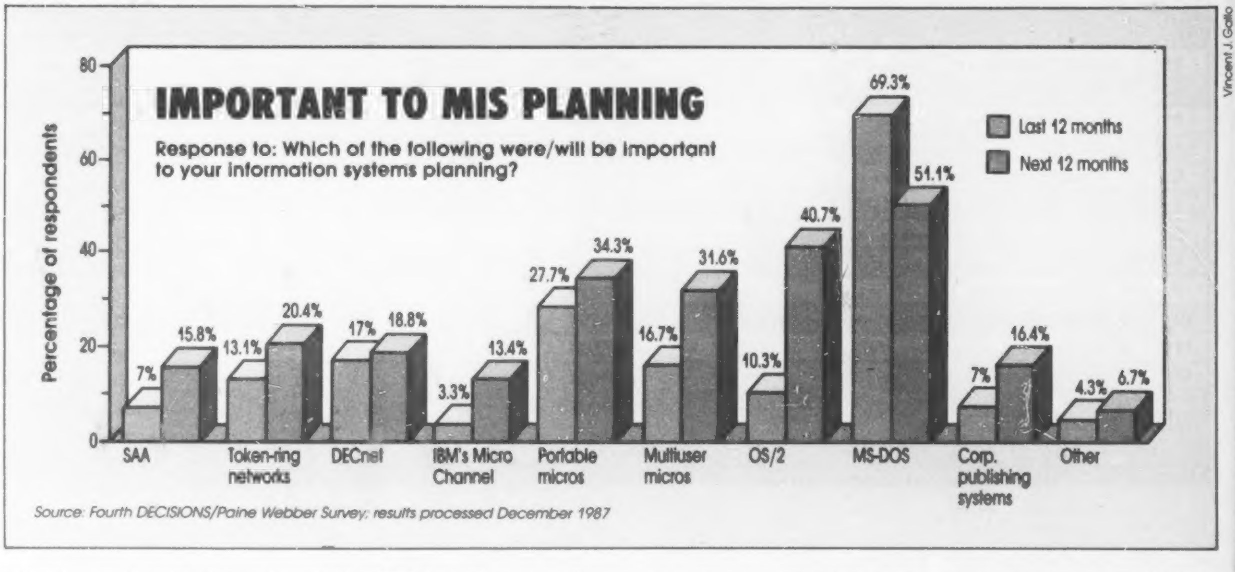
The thunderous arrival of the PS/2 has distracted attention away from a quiet revolution taking place in the peripherals segment of the micro market. Sales of high-end laser printers to corporations are growing at a rapid rate, spurred on by desktop publishing software and local-area networks that permit easier sharing of fast, high-quality printers. "We see laser printer use growing at 30 percent to 40 percent a year, and we're a long way from market saturation," says James L. Busby, CEO of QMS Inc., a supplier of laser and impact printers that had a huge jump in revenues last year. Busby says QMS's strategy is to plug products into all pricing levels, and to participate in numerous dis-

Peripherals

Alan Whitman

James L. Busby of QMS Inc.

> *'Laser printer use will grow at 30 to 40 percent a year.'*



Source: Fourth DECISIONS/Paine Webber Survey; results processed December 1987

tribution and sales channels and the OEM market as well.

Others that are well-positioned to cash in on the rapid growth in laser printer sales to corporations are IBM, Apple, and Hewlett-Packard Co., because of strong sales tie-ins with their microsystems and their ability to sell high-quality products with high profit margins. Those likely to suffer are suppliers with lower-priced printers because profit margins will be eaten into by discounting and by growing competition.

A key to the popularity of laser printers has been Postscript, the page description language from Adobe Systems Inc. Postscript has propelled Adobe Systems onto the micro software fast track. From sales of $2 million in 1984, Adobe's annual revenues shot up to $39 million by the end of 1987. Postscript is licensed by virtually all laser printer vendors, the major exception being Hewlett-Packard, which uses a proprietary standard for its Laserjet's device-independent interface. Among the heavy hitters that have rallied around the Postscript standard are IBM, Apple, QMS, Texas Instruments Inc., Digital Equipment Corp., and NEC Information Systems Inc.

"This is a royalty business, and the increasing popularity of laser printers is due in part to the fact that Postscript has become so universal," says John E. Warnock, president of Adobe Systems. Warnock says the biggest threat Adobe faces is cloning. "We've had 14 competitors announce that they would clone [Postscript], but none has succeeded yet," he reports. Warnock says Postscript is difficult to clone because of strong proprietary technology, favorable licensing agreements, and aggressive upgrades on the part of Adobe.

A development to watch in software is the forthcoming Release 3.0 of Lotus Development Corp.'s 1-2-3. The package is being rewritten in the C language to take full advantage of OS/2 on Micro Channel PS/2s. According to John McCarthy, the new version of 1-2-3 should help boost sales of Micro Channel machines further because, he says, "PC AT-based micros don't have the memory and performance to take advantage of the upgrade." The new 1-2-3 will also create a fair amount of havoc among the vendors offering Lotus add-ons. "They are going to have to rewrite or tweak their products to link up [with Release 3.0], and that's going to create a lag," McCarthy asserts.

If Lotus is successful in its development and marketing efforts of the new release of 1-2-3, it may well regain the top ranking among independent micro software companies. This year's DECISIONS survey shows Lotus slipping to second place despite a 33 percent increase in revenues. Microsoft Corp. surged ahead of Lotus on the strength of a 67 percent gain in revenues.

Robert Therrien, software analyst at Wall Street brokerage Paine Webber Inc., doesn't expect the coming of PS/2 to have a dramatic impact on the software segment just yet. "DOS still has a lot of life, and Micro Channel isn't essential to run OS/2," he says. "The major application vendors will continue to do well, even though they face a lot more competition."

Among sellers of word processing software, Wordperfect Corp. continues to outrun its competition. Wordperfect's sales for 1987 surpassed $100 million, and the company expects revenues to exceed $170 million in 1988. Wordperfect's success seems to stem from the fact that it offers a full-function package that runs on numerous hardware platforms (including the DEC VAX), responsive customer service, and a constant stream of new releases. Version 5.0 of Wordperfect, which will include some major enhancements, is scheduled for availability late this month. Wordperfect is on the verge of becoming a corporate standard in the fragmented word processing arena. Its sales far outstrip those of the leading word processing package in earlier times, Wordstar from Micropro International Corp.

Therrien sees fertile markets in the areas of communications and database software. "These are the products that tie micros together and get maximum results," he says. Therrien doesn't expect one vendor to provide the solution in both areas. Instead, he speculates that a database engine could emerge that is a good match with an improved communications program. "If this happens," Therrien reasons, "a major advance will be made in terms of moving microcomputer use from a numerical orientation to a character orientation." **D**

Patrick Flanagan is a freelance writer based in New York. Laura Daly, a freelance editor based in Maywood, NJ, contributed to this report.

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COMPUTER DECISIONS

MIS BUILDS A MICRO

Decisions Micro Consensus
Dell/Decisions Consensus PC

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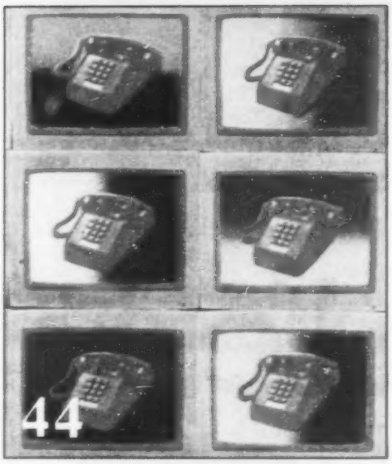

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EDITOR'S MESSAGE

The Hole in the Machine

We were of course gratified by the response on the part of IS professionals to our challenge to "design" the microcomputer that represents an optimal configuration for corporate applications (see cover and page 40). What we really asked for, however, was a practical *definition*, rather than a design. Anybody can fantasize in the realm of price-is-no-object technology or dream about ultimates; we wanted to know what a package of today's off-the-shelf parts would look like if our readers built it by consensus.

That definition, translated into hardware with the cooperation of Dell Computer Corp., feels pretty good to us. Having a 16-MHz 386 chip and 2 Mbytes of extended/expanded memory in hand to attack the latest upgrades of the ever-popular DOS applications is like taking off on a two-lane blacktop in a custom-tooled European road machine—the family sedan will never feel the same. Even when OS/2 turns the highway into a networked Autobahn, this level of performance should still be in tune with the medium.

Having said that, I am also bound to report on what I perceive as the consensus's failure to produce a configuration that successfully addresses the myth of microcomputer expandability. Faster than you can say "eight great slots," we had them filled. Dell had already taken five slots: the disk controller, the system memory board with its extra-fast static RAM, the VGA video card, and a parallel/serial card with an extra serial port in the slot next door. Then it was our turn: In goes our network board; next, the interface card for a 40-Mbyte removable cartridge drive; and finally a rather imposing sandwich of a full-length board that drives an extra monochrome monitor capable of 300 dots-per-inch resolution.

Toys, you say. Not really; one can make a case in the name of better, faster electronic publishing for all of these things. I'm sure there are plenty of slot-starved users out there in mainstream corporate departments with similar, if not more readily justifiable, needs. So far as playtime goes, I'm sitting here with my bus mouse port in one hand and my joystick jack in the other—shut out for lack of space.

We need machines with more holes in them.

Robin Nelson

Cover Photo:
Roberto Brosan

THE MIDRANGE STRUGGLE: IN THE SHADOW OF GIANTS

As MIS consolidates midrange systems spending on DEC and IBM, the 'mini Bunch' vendors must find new ways to grow.

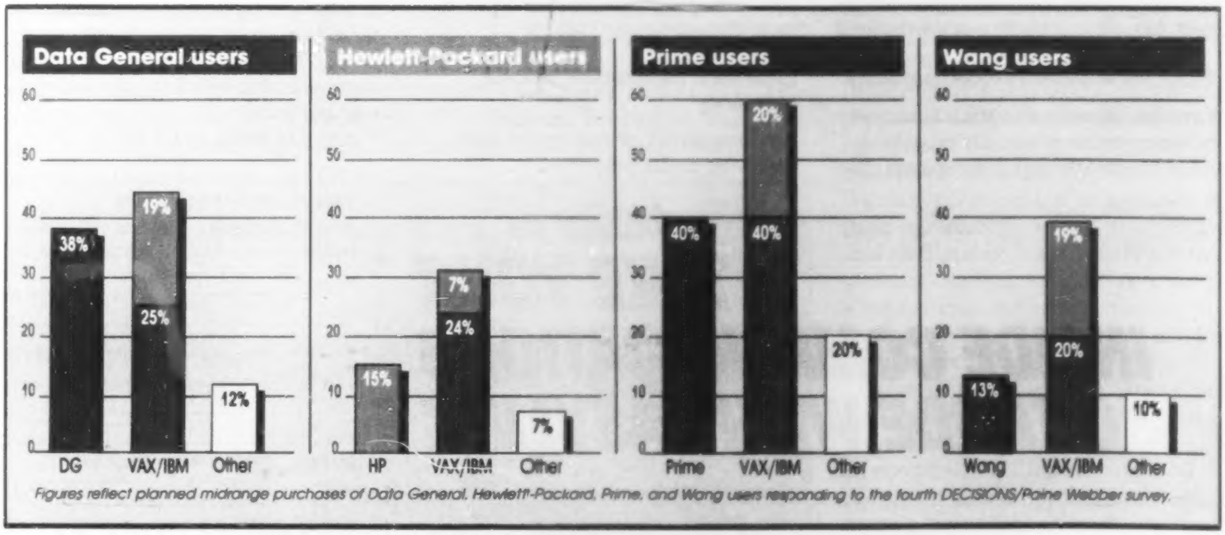
by Robert Moran and Lee Keough

Back in the days before minicomputers were known as midrange processors, Data General Corp., Hewlett-Packard Co., Prime Computer Inc., Wang Laboratories Inc., and Digital Equipment Corp. racked up huge sales simply by selling a better mousetrap at a lower price than IBM. For all but DEC, that's no longer the case.

Faced with a need to smooth networking and reduce costs, MIS is employing fewer computer architectures. Increasingly, MIS short lists of processor suppliers contain but two names: IBM and DEC. Data General, Hewlett-Packard, Prime, and Wang have become a "mini Bunch" fighting to be seen in a market dominated by the two giants.

The four vendors face a much tougher sell to MIS, slower growth, and, in the case of Data General and Wang, financial losses. Data from the latest DECISIONS/Paine Webber Survey of MIS Attitudes (see chart) tell a daunting story for the four. Data General, Hewlett-Packard, Prime, and Wang can't rely on their user bases for heavy repeat sales; many of their current users plan to buy new processors from IBM and DEC.

The movement of midrange spending to IBM and DEC is likely to accelerate. "Prime has a super machine, and I like Data General's CEO office



Figures reflect planned midrange purchases of Data General, Hewlett-Packard, Prime, and Wang users responding to the fourth DECISIONS/Paine Webber survey.

Vincent J. Gallo

MIDRANGE SPENDING: FOCUSED ON DEC AND IBM ■ VAX ▨ IBM

Data from the latest DECISIONS/Paine Webber Survey of MIS Attitudes indicate MIS is putting more dollars into DEC and IBM midrange systems than into systems sold by Data General, Hewlett-Packard, Prime Computer, and Wang Labs. Percentages reflect purchases from many vendors; thus, they don't add up to 100 percent.

Greg Ragland

environment better than [DEC's] All-in-One, but those issues are small considerations in the overall scheme of things," says Larry Goetz, manager of corporate planning for CSX Corp., a major transportation company based in Richmond, VA. "We have IBM and DEC in every one of our subsidiaries. It's just not feasible to have one Data General or Prime computer in a sea of IBM and DEC." Within five years, says Goetz, CSX will phase out its Data General and Prime systems.

Not all users have reached the decision Goetz has, but the mini Bunch vendors themselves recognize that more will. "Five years from now, there will be very few large general-purpose hardware suppliers other than IBM and DEC," says Robert Fischer, Prime's vice president of computer-aided design and manufacturing systems. The question is, which of the four will survive as large, integrated, general-systems vendors?

Midrange spending trends are the most immediate problem for the mini Bunch, but not the only one. All midrange vendors face erosive competition from local-area networks linking powerful microcomputers. Analysts expect Operating System/2 to accelerate the installation of these LANs—at the expense of minicomputers.

And then there's the Unix question. Unix is good news, bad news, and worse news for the mini Bunch. The good news is that Unix allows a vendor to sell to government accounts and may free it from heavy operating system development costs.

The bad news is that the mini Bunch vendors have big office/commercial customer bases that must be sold on Unix. George Weiss, small systems analyst at the Gartner Group Inc. (Stamford, CT), expects Data General's VOS, Hewlett-Packard's MPE, Prime's Primos, and Wang's VS operating systems to "vaporize" as users demand Unix, but the process will be slow. That means dual operating system support—an expensive proposition—for years to come. Worse, moving to Unix thrusts vendors into the hotly contested Unix platform market. Again, visibility in a crowd will be a problem.

MIS managers are asking many questions of the four computer makers. They want insight into strategies for marketing, technology, service and support, networking, and systems integration, and they want to know how the vendors plan to grow and stay healthy. The answers to these questions will help MIS decide whether to continue dealing with a mini Bunch vendor and on what terms.

Each vendor is adapting in its own way. Here's how they stack up:

DataGeneral

Data General Corp.
Westboro, MA

Sales	Profits (Losses)
1987—$1.3 billion	1987—($118 million)
1986—$1.29 billion	1986—($27 million)
1985—$1.2 billion	1985—$2.4 million

Strengths

1. High-quality VAR and OEM distributors
2. Good processor price/performance ratios
3. CEO software

Weaknesses

1. Weak service and support
2. VAR/OEM reliance reduces profit margins
3. Ineffective marketing to corporate accounts

Questions/doubts

Will return to VAR/OEM roots fuel or stunt growth?

Of the four vendors in the mini Bunch, Data General faces the greatest struggle. "Data General is foundering," says John Logan, director of research for the Yankee Group, Boston. After losing $127 million in fiscal 1987 and $29 million the year before, Data General finally turned a profit of $12.4 million in the quarter ending December 31, but the gain mostly reflected reduced costs.

The company's strategy is to regroup by concentrating on its original equipment manufacturer and value-added reseller distributor network. The strategy has received a loud Bronx cheer from analysts. According to Logan, users are saying that if Data General can't compete for major accounts, it isn't good enough for ma and pa shops, either.

Data General officials counter that they can't justify devoting such large resources in attempts to compete with IBM for major corporate accounts. For whatever reason, says Ward MacKenzie, vice president of corporate marketing, Data General is unlikely to beat IBM to these accounts, and so it will confine end-user sales efforts to its installed base.

MacKenzie asserts that analysts don't understand the value of Data General's OEM and VAR channels. Aggressive price discounts to resellers and migration centers for third-party software vendors have helped Data General gain 100 new VARs in the past year, he notes.

Few criticize Data General's basic technology. Its processors are respected for their price/performance ratios, and its CEO office software is highly regarded by users. Analysts like Logan, however, say that a retrenchment won't reverse Data General's lateness with key connectivity products. The vendor was late with micro integration products, for example, although it now offers proprietary as well as X.400 connectivity to IBM systems.

Retrenchment also won't necessarily bolster Data General's poor reputation for service and support, or instill it with instant marketing savvy. "Data General's problem is sales and marketing," says Patricia Seybold, a Boston-based consultant and DECISIONS columnist. "It can't sell its way out of a paper bag."

Recognizing its marketing problems, Data General has beefed up its sales force, expanded its field service operations, and added remote diagnostics capabilities.

Bob Hantack, vice president of Beneficial Data Processing Corp., the Peapack, NJ, dp subsidiary of Beneficial Corp., says he asked tough questions of Data General—and got good answers. He'll stick with Data General—the account is worth about $60 million—for the time being. "Data General was very candid with us about their financial problems," says Hantack. "The company seems to be turning things around."

Still, Hantack's loyalty will last only as long as Data General stays abreast of the competition. "I would look at other vendors, but at this point I would look at Data General and IBM most closely, because we've standardized on those two," he says.

HEWLETT PACKARD

Hewlett-Packard Co.
Palo Alto, CA

Sales	Profits
1987—$8.1 billion	1987—$644 million
1986—$7.1 billion	1986—$516 million
1985—$6.5 billion	1985—$489 million

Strengths

1. Good processor price/performance ratios
2. Large line of PC products
3. Strong service, support, and DBMS

Weaknesses

1. Low profit margins on micro products
2. Customer doubts caused by delays in delivery of new midrange line

Questions/doubts

How fast will HP 3000 users migrate to an entirely new architecture?

Hewlett-Packard Co. is the strongest of the mini Bunch, only partially because it is the largest. After weathering a halting start to its new family of Precision Architecture (also known as Spectrum) processors, Hewlett-Packard is mustering a major challenge to DEC's position as the top midrange systems vendor.

Precision Architecture is based on a reduced instruction set computing (RISC) design, which has been incorporated into the HP 3000/900 series of general-purpose computers and HP 1000/800 engineering machines. RISC streamlines the machine instructions needed to run a computer and simplifies design by hardwiring instructions that are usually written into microcode into the processor itself. The result: increased performance coupled with lower manufacturing costs. Precision Architecture computers cost from 40 percent to 60 percent less than similar machines marketed by IBM or DEC.

Hewlett-Packard is poised to take advantage of its Precision Architecture now, but it has paid a heavy price. Precision Architecture has been best known until now for the delays in its arrival. Two factors contributed to the delays. First, existing applications, although compatible with the new RISC design, won't run faster under it unless they are modified. Hewlett-Packard established a migration center—at considerable cost—to accomplish these conversions. Second, as the HP 3000 Models 930 and 950 were being readied for market, Hewlett-Packard discovered a bottleneck in the input/output channels under its MPE operating system that negated the performance advantages of RISC. The result was a six-month delay in the introduction of the 930 and 950. Hewlett-Packard's Unix-based engineering processors were introduced without a hitch.

Hewlett-Packard's fits and starts fueled doubts about its ability to deliver a new architecture. John Logan believes the company's success will be determined by how aggressively it markets its systems this year. So far, he says, so good. "The product has been shipping only five months, but we estimate HP has sold $100 million worth of midrange systems that DEC was capturing," says Logan. In Logan's view, Hewlett-Packard has been able to seize an advantage over DEC due to its superior DBMS, as well as the relative low cost of its systems.

Not all analysts are as sanguine. The latest DECISIONS/Paine Webber survey shows that only 15 percent of those MIS executives who have Hewlett-Packard machines installed plan to buy new Hewlett-Packard processors this year. "A lot of people are looking for HP to be the next DEC on the basis of Spectrum, but our survey does not support that conclusion," says Stephen Smith, hardware analyst at Paine Webber.

Hewlett-Packard trumpets five advantages over DEC: better processor performance for the price, a superior database management system, a longstanding commitment to Unix, more functional microcomputer integration, and top-flight service and support.

More than any other midrange vendor, Hewlett-Packard has made the micro an integral part of its office systems product line. The company dominates the office laser printer market, sells a line of IBM Personal Computer clones, and recently has distinguished itself as a software innovator. New Wave is an object management extension to Microsoft Corp.'s Windows and OS/2 Presentation Manager, and HP Access gives micro users access to HP 3000 files and certain IBM mainframe files without switching to terminal emulation. Raymond Pawlicki, an assistant vice president for Citicorp (New York), says HP Access is a reason to keep upgrading with Hewlett-Packard processors rather than migrate to another vendor. The product "makes a three-tiered environment a reality," he says.

Many users give Hewlett-Packard high marks in service and support, a fact that analysts believe may be the company's greatest advantage. James Conroy, corporate director of MIS for Reliance Electric Co. (Cleveland), stuck with Hewlett-Packard despite its Precision Architecture delays principally because he likes dealing with the company. "We waited because HP is a good company, and we knew it would ultimately solve the problem," he says.

Prime™

Prime Computer Inc.
Natick, MA

Sales	**Profits**
1987—$961 million	1987—$65 million
1986—$860 million	1986—$47 million
1985—$770 million	1985—$58 million

Strengths

1. Good processor price/performance ratios
2. Strong CAD/CAM hardware and software
3. New focus on CAD/CAM market

Weaknesses

1. Incompatibilities between operating system upgrades
2. Ineffective marketing to corporate accounts

Questions/doubts

Will new reliance on CAD/CAM fuel high growth?

Like Data General, Prime Computer has abandoned efforts to become a general systems vendor marketing to end users. Unlike its neighbor on Route 128, however, Prime is not retrenching. Rather, it is moving aggressively to become a major supplier of manufacturing systems.

CAD/CAM comprises only a small portion—about 18 percent—of Prime's revenue. But the recent acquisition of Computervision Corp. (Bedford, MA), a troubled but big CAD/CAM software vendor, makes Prime a major player in the market. Prime's Robert Fischer estimates that with Computervision, Prime's world CAD/CAM market share will rise from 3.5 percent to about 17 percent. IBM's share is 25 percent.

CAD/CAM is the first piece of the new Prime. Future acquisitions will bolster Prime's offerings in three areas: manufacturing management systems, like cost estimating, materials management, and process planning; shop floor systems; and custom systems and systems integration.

Fischer says Prime will focus on wooing customers that have revenues of from $5 million to $1 billion, thereby minimizing potential clashes with IBM and DEC. With the strategy, Prime hopes to become a major force in a market characterized by small suppliers.

But Prime has much work to do. George Weiss of the Gartner Group believes that Prime must divide applications between its midrange and micro platforms to achieve its goal. "If users have to divide, reprogram, rerun applications, recompile, or do a lot of file transfers, they won't," he says.

Prime responds that support for a range of networking systems will be the glue that joins its micros, workstations, and midrange processors. Currently, Prime's bread-and-butter Model 50 Series processors only support Ethernet and TCP/IP networking protocols. Fischer promises support for Sun Microsystems Inc.'s NFS and Apollo Computer Inc.'s NCS protocols by midyear on the Model 50 Series, and support for native Unix at an unspecified future date. Prime also offers a gateway between its processors and SNA, an important consideration in commercial systems.

Prime's manufacturing systems strategy requires a rapid move to Unix, which is the preferred operating system in engineering and shop floor applications. Prime, thus, will be the first of the mini Bunch to experience the pain of transition to Unix. About 90 percent of installed Prime systems are running under Primos, says Fischer. Robert Miner, operations manager at Arizona Land Resource Information Systems (Phoenix), the dp arm of the state's Land Department, says his investment in Primos applications keeps him in Prime's camp.

Unix may change one aspect of Prime's operating system strategy. Users may no longer have to convert applications every time Prime gives them a new version of operating system software. Miner wouldn't be sad if this practice died. "'I've been a Prime user since Primos Revision 17," he says. "We are now at Revision 21, and Prime doesn't support upgrade compatibility. I've had applications completely go away."

WANG

Wang Laboratories is still struggling to convince MIS that word processing is its past and not its future. Wang's well-known ads touting its abilities as a general-systems vendor are the most visible of its tactics in approaching MIS, but the company is also banking on new image-processing technology to help change its image.

President Frederick Wang has set "perception" of Wang as the number-three systems vendor as one of his corporate goals for the next two years. The others are a 10 percent after-tax profit margin, $5 billion in revenues, and improved customer satisfaction. Wang was seventh on the last DECISIONS Performance Report ranking of systems vendors (June 1987), with revenues of $2.7 billion.

Analysts regard Wang's goals as ambitious, but Wang officials are confident. "In many places, Wang is the vendor of choice or at least the second choice," says Gerald Paul, vice president of business development.

For growth, Wang is relying on image processing to open new office markets. Wang has been selling image processing since 1984, when it introduced the Professional Image Computer. Last year, that machine became the Wang Integrated Image System (WIIS). Wang estimates the potential market for image processing to be about $2.5 billion. Although critics chide Wang for adopting its expensive broadband coaxial cabling as the transmission medium for WIIS, corporations can substitute twisted-pair wiring on portions of their WIIS networks. In the future, says Paul, Wang will give users the ability to run image processing over Ethernet cabling.

Wang Laboratories Inc.
Lowell, MA

Sales	Profits (Losses)
1987—$3.1 billion	1987—$94.6 million
1986—$2.7 billion	1986—($81.3 million)
1985—$2.4 billion	1985—($63.3 million)

Strengths

1. Good mainframe connectivity products
2. Strong DBMS software
3. Improving customer support

Weaknesses

1. Reputation for weak software support
2. Slow introduction of key products
3. Reliance for growth on untested technology

Questions/doubts

Will new imaging technology take off anytime soon?

Gartner Group's George Weiss notes that the outlines of Wang's image processing strategy are not new. Wang has sought the magical new technology that would fuel high growth before, he says. Among its attempts: integrated voice and data communications, private branch exchange integration, and broadband LANs. None have succeeded, Weiss notes.

Wang's quest for the technological Holy Grail has distracted it from becoming a general-systems vendor in the ranks of DEC and Hewlett-Packard, Weiss believes. "MIS is ambivalent—in many cases negative—about Wang because of its tardiness in becoming a general data processing and office systems vendor," he asserts.

Wang's reputation has suffered in spite of its technology, which analysts agree features solid general-purpose processors with superior IBM connectivity and strong Unix support. Wang's processors can run both Unix and its VS operating system in efficient native mode. Greg Marus, an analyst at Dataquest (San Jose, CA), believes Wang has moved further than any of its competitors toward "mixed mode" processing—the combination of data, text, image, and voice processing. This progress, he believes, will give Wang an advantage in the development of new systems.

Other criticism of Wang centers on its lateness in delivering key products and its lax software support. Paul asserts that Wang has turned the corner on the support problem by establishing four support centers throughout the country. Ted Hutton, manager of systems and services at the Port of Seattle (WA), confirms that the new centers have quickly improved Wang's customer support. Most software problems are handled over the phone, Hutton reports. He adds that as long as Wang can serve his organization's needs, he will stick with the vendor.

More than any of the other mini Bunch vendors, Wang faces severe competition from LANs. Many corporations are replacing their small Wang minicomputers with networked PCs linked to electronic-mail systems from IBM or DEC, says Patricia Seybold. "Corporations typically had electronic mail in place before they bought Wang office systems," she says. "Although some large Wang customers are still committed to Wang's electronic mail, they are in the minority."

Gerald Paul acknowledges the trend toward replacement of dedicated word processors with PCs, but downplays the impact on Wang. "Word processing accounts for a very small portion of Wang's overall data processing and communications offerings," he says, "especially compared with what it was three or four years ago."

Looking Ahead

There are more questions than answers about the mini Bunch, but at least the direction that each vendor is taking is clear. Ultimately, MIS managers must decide, as did Data General user Bob Hantack of Beneficial, whether to stick with systems diversity and on what terms.

Those terms may continue to change. The industry's rapid pace of development means market positions are fleeting at best. Long-term, Patricia Seybold counsels MIS to keep an eye on service and support as the most vital offerings of any vendor, not just those selling midrange systems. She believes the future belongs to vendors that can offer sophisticated systems integration services, be they hardware vendors, software houses, or companies like Arthur Andersen & Co.'s information systems unit.

The systems vendors Seybold believes have the capability of becoming systems integrators are Hewlett-Packard and Wang, and, not surprisingly, IBM and DEC. These companies, says Seybold, have been using technology to support their own businesses, and will leverage that experience. For now, MIS must decide which vendors are worth staying with for the long haul by asking hard questions and demanding answers. **D**

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Special DBMS Report:

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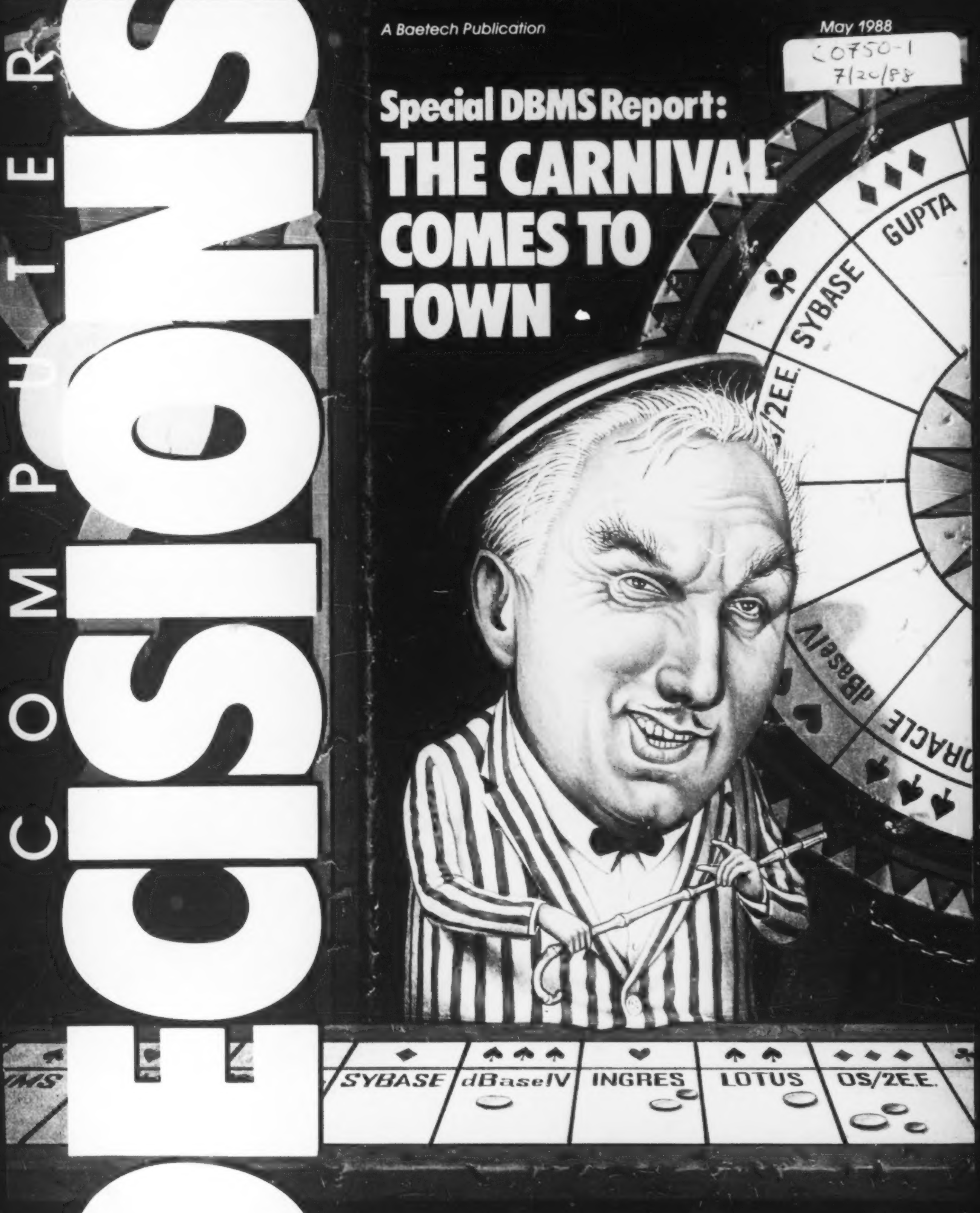
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EDITOR'S MESSAGE

The Sideshow in Palm Springs

Anyone who thinks vendors aren't eager for a piece of the new corporate DBMS action should have attended one particular session at the software industry's recent Adapso conclave in Palm Springs, CA. The panelists here happened to be Larry Ellison and Ed Esber, CEOs, respectively, of Oracle and Ashton-Tate. The subject was supposed to be networks. What instantly developed was a first-class competitive catfight over the relative lack of merit of "one-size-fits-all data managers" (Oracle's DBMS as seen by Esber), and the "utter nonsense" (in Ellison's view) of trying to integrate dBase IV on micros as part of an enterprise system spanning databases on mainframes, minis, and workstations.

In addition to alienating an entire audience who showed up to hear something completely different, the two managed to target and detail specific areas of high risk in each other's offerings. A tape of the full session is available from Adapso; I recommend it to anyone considering either of these DBMS solutions.

DECISIONS has also illuminated the major risks of the new micro DBMSs in this issue's Special DBMS Report beginning on page 35. We feel that the highest risk of all for corporate information managers would be to withhold consideration of the new technologies, particularly those with potential for distributed databases, until "the confusion clears up."

The confusion is only going to clear up for the MIS executives and administrators who begin to assess right now how these services and methodologies will help their corporations compete in the years ahead. It means cutting through a lot of smoke blown by vendors who give MIS all kinds of lip service at the same time they are telling end users to throw off their chains and buy independently. "We have tended to treat MIS like hobbyists," Ellison confessed in a moment of passion at the Adapso session. "We give them all this stuff and tell them to connect it." Not to be outdone, Ashton-Tate's Esber suggested that the client/server methodology his company will market jointly with Microsoft and Sybase is "a win for MIS" over what he calls the "freedom fighters" in the user departments.

Both CEOs promised that their respective companies will go to all ends to improve service and support of micro- and LAN-based DBMS solutions—working, so the implication goes, hand in glove with information managers.

Do they really mean this? If I were you, I'd need to see some proof.

Robin Nelson

Cover Illustration:
Joseph Salina

TECHNOLOGY TRENDS/Microsystems

A PLATFORM TO BUILD ON

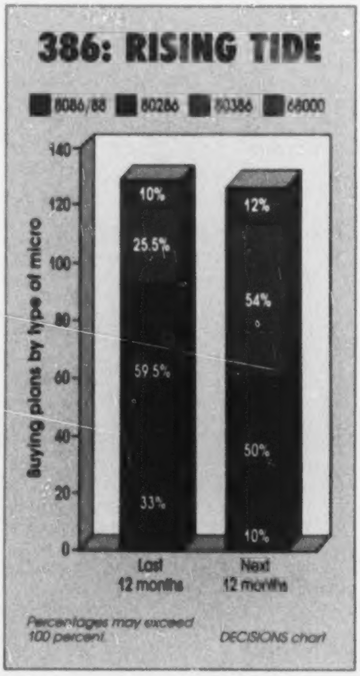
John Rymer

The march of microcomputer technology may finally be slowed by an internal force: the Intel 80386 microprocessor. Expectations of an 80486 chip notwithstanding, many MIS managers are settling on 386 micros as a technological plateau—a chance to catch up to recent rapid changes.

The numbers bear out the 386's growing popularity. Respondents to the latest DECISIONS/Paine Webber Survey of MIS Attitudes indicate they'll be buying more 386 micros during the next year—as many as 286-based machines (see chart). At a recent roundtable sponsored by DECISIONS, a group of micro managers from major corporations said they expected corporate buying of 386 micros to accelerate as prices for those machines fall during the next year or so. The prices of 386 micros like IBM's Personal System/2 Model 80, which ranges from about $7,000 to $13,000, discourage volume buying, they said. IBM is expected to cut PS/2 prices soon, although at press time it had yet to make any move to do so. The fact that hordes of vendors are selling 386 machines should make for lower prices.

Pure power is not the reason 386-based micros are likely to have a long and profitable run in corporate America, although it helps. Rather, MIS likes the 386 chip because it is ideal for multitasking under either MS-DOS or Operating System/2. Applications can be placed in their own slices of a 386 processor, or "virtual machines," and run virtually simultaneously, as if they were on separate micros. The 80286 chip can run applications in a virtual-machine mode, but it can't protect those modes from crashes. "Protected-mode multitasking is the key," says Ron Acher, manager of organizational analysis and systems at Con Edison, the New York-based power utility. "With OS/2 on a 286, I may be able to run nine pieces of software under Windows [from Microsoft Corp.], but if one crashes, I lock up the whole machine."

"With 20-20 hindsight, nobody would have designed the 286 chip," says Jerry Schneider, president of the Capital PC Users Group (Washington). "We would have started with the 386." With software like Redmond, WA-based Microsoft's Windows, applications in 386 protected mode can also be linked interactively. Acher notes that this allows MIS to tailor sets of applications to individual users, creating, in effect, integrated software packages.



Based on responses to the question "What kind of micros did/will you buy during the next 12 months?" on the fifth DECISIONS/Paine Webber Survey of MIS Attitudes.

Acher believes that within five years, corporations will have two IBM microcomputer standards: 386 micros running MS-DOS, and 386 micros running OS/2. Most 386 workstations, he predicts, will be standard bus machines, not micros based on IBM's Micro Channel bus. Schneider, however, believes OS/2 will be more widely used.

The 386 will spread in corporations in part because of the availability of inexpensive accelerator boards for existing IBM Personal Computers, Acher adds. The cost of a 386 upgrade, including additional memory and software, is about $2,000.

"Accelerator boards also allow you to stick with the PC-standard bus, delaying the move to IBM's Micro Channel," adds W.B. Browning, a Washington-based consultant and officer of the Capital PC Users Group. Interestingly, as prices for 386-based micros fall, Intel's 386 enhancement boards are getting much more expensive. In March, Intel raised prices on its Inboard 386/PC, which upgrades an IBM PC or PC XT, by 30 percent, to $995. The base model includes 1 Mbyte of memory. Inboard 386/AT costs $1,595 without additional memory, and $1,895 with 1 Mbyte of onboard memory.

One roundtable participant doesn't see the 386 as a technological plateau. Ted Klein, president of the Boston Systems Group and the Society for the Management of Professional Computing, urges MIS not to get too comfortable at any level of technology. "History is against the plateau theory," he says. "I remember people saying nobody would ever need more than the 286."

Nevertheless, Acher insists that users won't begin to take full advantage of the 386 for some time to come. An appropriate historical analogy is the V-8 engine, he says. It was invented in the 1920s, perfected in the '30s, and remained the standard until the '70s. Klein doesn't believe the engine analogy holds up in the micro world. Standard interfaces to major operating systems will promote innovation and improvement, he says. When the 486 chip appears, the question won't be whether to move to it, but whether IBM will have its own version of the chip, parting company with the rest of the industry, Klein says.

SCSI: THE CHEVY OF INTERFACES

Embedded small computer systems interface (SCSI) controllers in storage subsystems offer users another peripheral interface option. SCSI usually costs a bit more, but the flexibility of the interface, if not its speed, may be worth the extra expense.

Manufacturers of disk drive controllers can use a single SCSI interface for a variety of devices, changing the bus adapter chips as needed to match selected hosts. SCSI interfaces offer price/performance competition for micro and workstation device-level interfaces like ST-506 and ST-412, the enhanced small device interface (ESDI), and the enhanced or high-level storage-module drive (ESMD). Improvements to SCSI are bringing it into competition with Intelligent Peripherals Interface (IPI) levels 2 and 3, which are featured on IBM 937X system peripherals (see chart).

SCSI puts more value in drives for users, says James Porter, president of Disk/Trend Inc., a consultancy in Mountain View, CA. SCSI chips embedded in drives take up less space than older interface boards and reduce cabling and maintenance costs, he says. Porter sees SCSI as playing a role in making the Apple Computer Inc. Macintosh more "office-acceptable." The addition of SCSI interfaces to the Apple Enhanced Macintosh series has permitted a wide range of office peripherals to provide Mac compatibility that wasn't possible on older Apple computers.

SCSI also eliminates costly adjustments to software drivers that must be made for interfaces like ST-412 to allow the host to switch to another peripheral of the same type with a different storage capacity, according to Joe Molina, president of Technology Forums, Chanhassen, MN-based coordinator of the SCSI Forum.

SCSI's storage buffering allows faster access between host and tape drives, keeping the drives streaming without interruption, notes Kim Kelly, product marketing manager of quarter-inch products and subsystems at Cipher Data Products in San Diego. Molina adds that SCSI's ability to disconnect from hosts and conduct transactions with peripherals cuts down on "command overhead"—the time it takes for a peripheral to receive a command and put it into action. Command overhead can take up valuable bus time, he says.

SCSI's Copy Command Set allows data to move directly from disk drives to tape in response to a "copy" command without involving the host. This saves host time formerly wasted on backup functions. The Copy Command Set has been adopted as a standard by the American National Standards Institute and is a subset of the proposed ANSI SCSI II standard.

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THE DECISIONS/PAINE WEBBER SURVEY

BRING ON THE ALTERNATIVES

The fifth DECISIONS/Paine Webber Survey of MIS Attitudes shows information managers leaning toward LANs and Unix as major solutions.

by John Rymer

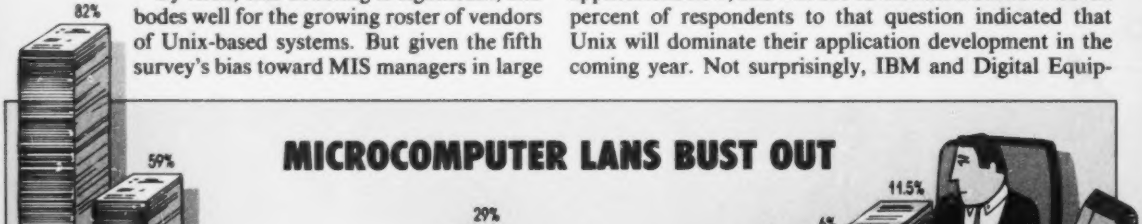
The latest DECISIONS/Paine Webber Survey of MIS Attitudes suggests a major shift in attitudes is under way. MIS managers are more seriously considering alternative computing platforms—like Unix and microcomputer-based local-area networks—than ever before.

Among respondents to the fifth of the quarterly surveys sponsored by DECISIONS and Wall Street securities brokerage Paine Webber Inc., 27 percent said Unix will be important to their information systems planning during the next 12 months. That's double the percentage of respondents who cited the importance of Unix on the third survey, conducted last September (see Figure 3).

By itself, this doubling is significant, and bodes well for the growing roster of vendors of Unix-based systems. But given the fifth survey's bias toward MIS managers in large corporations with IBM shops, the results can be interpreted as an even stronger vote for Unix. The 1,099 MIS managers who responded to the survey were drawn from a sample of 10,000 that intentionally excluded scientific, technical, and educational organizations, which otherwise would have skewed the results in Unix's favor.

If Unix is catching on in corporations, it's probably as a departmental supplement to operating systems already in use. This is a logical conclusion, given Unix's good track record in multiuser applications. It is also based on responses to a question about application development platforms. That question asked respondents to identify the development platform they use for the majority of applications now, and will use 12 months from now. Seven percent of respondents to that question indicated that Unix will dominate their application development in the coming year. Not surprisingly, IBM and Digital Equip-

MICROCOMPUTER LANS BUST OUT



Based on responses to: "Roughly what percentage of your organization's departmental/work group applications currently reside on microcomputer-based LANs? Roughly what percentage will reside on microcomputer LANs 12 months from now?"

Figure 1

DECISIONS chart

Chart by Graphic Chart & Map Co. & Vincent J. Gallo/DECISIONS ment Corp.—64.5 percent and 14 percent, respectively—will be the most widely used platforms in the coming year, according to respondents.

The responses indicate Unix has made a corporate breakthrough, says Paine Webber software analyst Robert Therrien. However, he adds, Unix vendors have much work to do. Above all, they must control expectations. "Unix lacks many features needed for transaction processing," Therrien says. "Nonetheless, the market is forcing Unix into these applications."

Micro-based LANs for departmental applications are also finding increased acceptance among MIS managers. In response to a question about departmental/workgroup applications residing on microcomputer-based LANs today and 12 months from now, the majority of respondents checked off "under 25 percent" in both cases. But the percentage of respondents planning to put more than 25 percent of departmental applications on LANs is triple the percentage reporting that level of LAN usage now. Also, as the accompanying chart indicates, the under-25 percent group shrinks over time, while those planning more LAN installations rises steadily. In part, this go-slow approach is undoubtedly due to the newness of the database technology necessary to support departmental applications (see the Special DBMS Report that begins on page 35).

The emergence of high-powered microcomputers and LANs as alternative platforms hasn't gone unnoticed on Wall Street, and one result has been tough trading sessions for the stocks of minicomputer vendors. Even DEC, a Wall Street favorite, has suffered. In fact, some analysts interpret DEC's recent reports of lower earnings and slower growth as a signal that the days of the minicomputer are numbered.

The fifth survey's results don't bear out such a conclusion, however. According to the several measures of corporate information systems planning included in the survey, minicomputer spending is strong and likely to remain so. Forty-six percent of respondents to a general question about the likelihood of spending increases and decreases in broad product categories said they expect to spend more

VENDOR REPUTATION INDEX

Calculated by adding percentage of respondents reporting favorable but unchanged opinion to percentage reporting opinion that changed for the better.

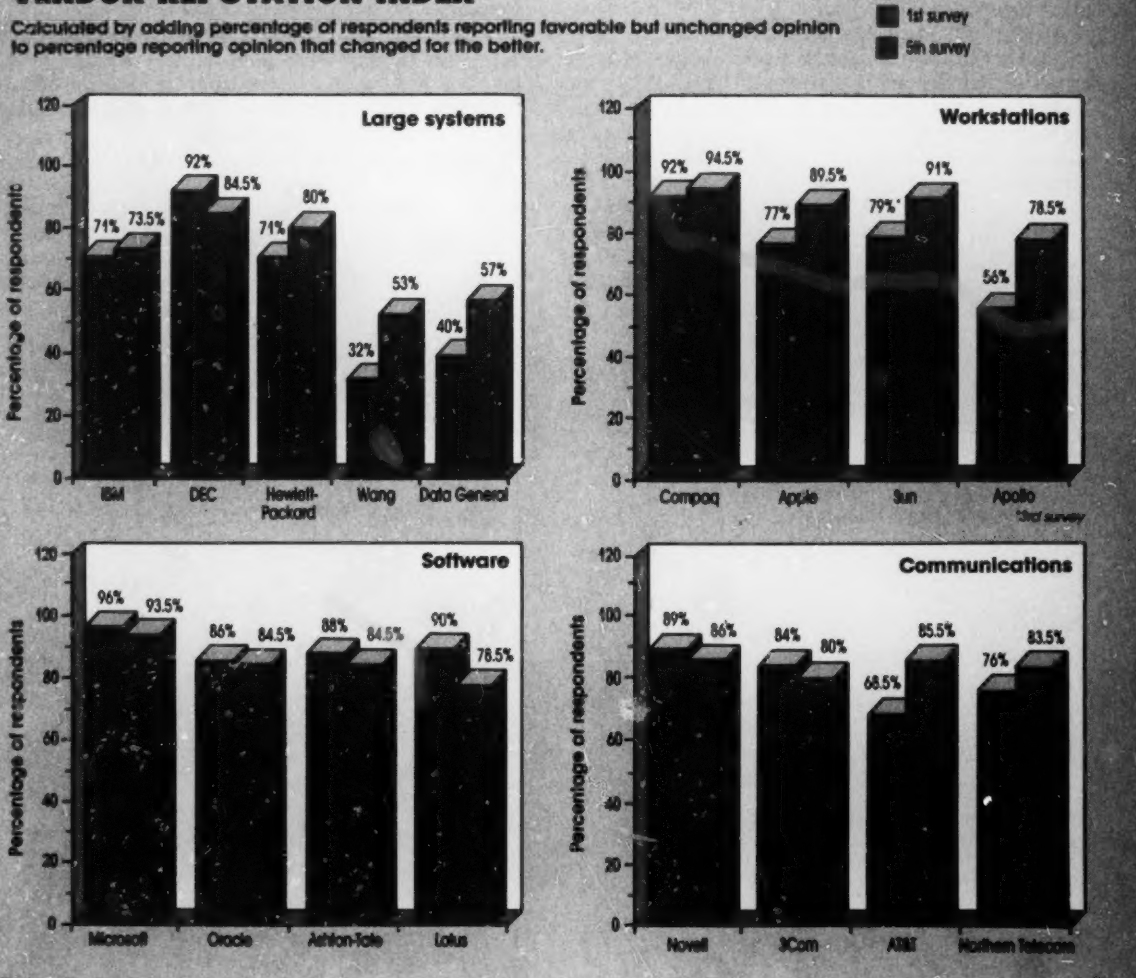


Figure 2

on minis during the next 12 months than the previous 12. Only 12 percent said their spending on minis will decline.

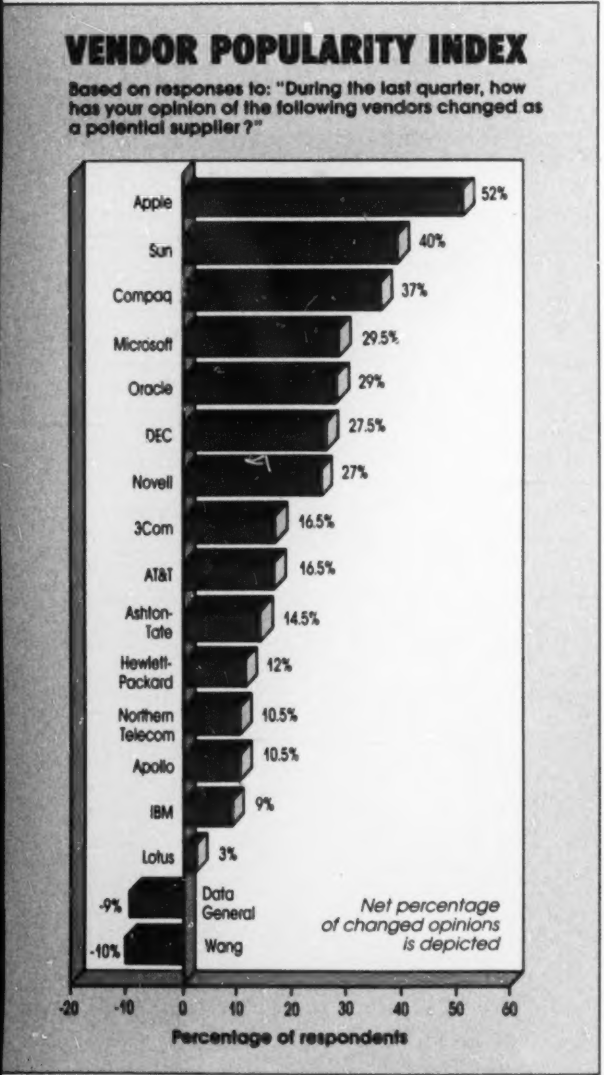
Among the mini vendors, DEC remains especially strong. Just short of half the respondents to a specific question about spending on DEC products said their spending will rise; only 8 percent said their DEC spending will decrease. On the fourth survey, taken three months earlier, 42 percent of respondents said they would increase their DEC spending, and 12.5 percent said they'd reduce it.

IBM, which has also been battered on Wall Street, can find plenty of good news in the fifth survey's measures of spending plans. First, mainframe spending in general is likely to increase, respondents say. In addition, a hefty 58 percent of the respondents to a question about spending on IBM products said they plan to spend more. That's 10 percent better than the response to the same question on the previous survey. At the same time, fewer respondents plan to reduce IBM spending—from 17.5 percent in the fourth survey to 12.5 percent in the fifth.

Another plus for IBM: Ten percent of respondents said they plan to buy IBM's slow-starting 937X midrange processor, up from 7 percent in the previous survey. Interestingly, these spending increases are indicated even though respondents report their total mainframe and minicomputer capacity during the year's first quarter dipped (see Figure 4).

IBM isn't without its problems, however. That's no surprise—on every one of our surveys, favorable results for IBM have been accompanied by some bad news. First, IBM has registered only slight improvement on the survey's Vendor Reputation Index, a broad measure of respondent attitudes toward individual vendors. In the year since we began compiling the index, which measures favorable short- and long-term opinion of vendors, IBM's ranking has improved by just 2.5 percent (see Figure 2).

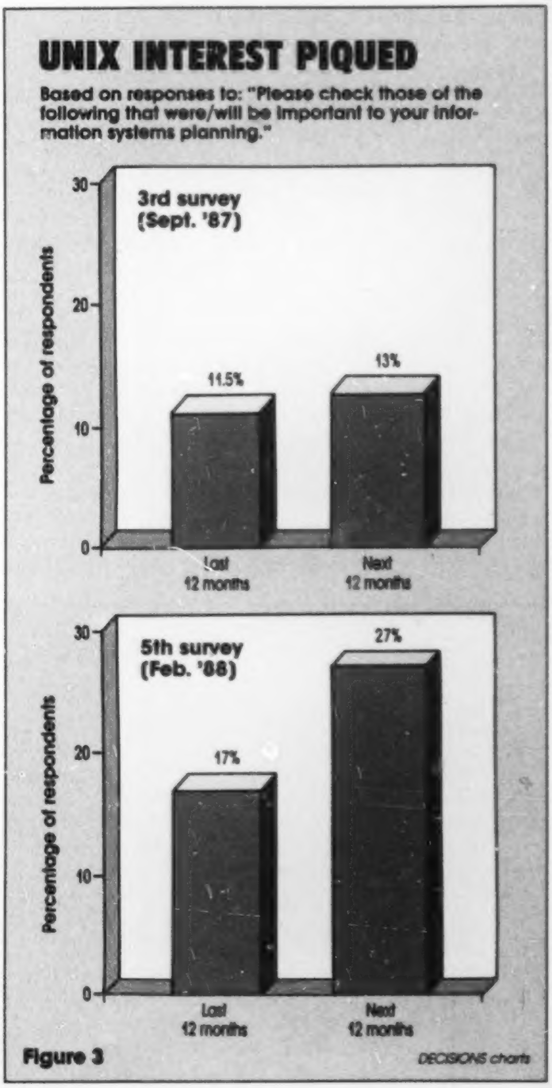
Second, respondents display little interest in IBM's Micro Channel architecture. Micro Channel is vital to IBM's effort to set a new standard for corporate personal comput-



VENDOR POPULARITY INDEX

Based on responses to: "During the last quarter, how has your opinion of the following vendors changed as a potential supplier?"

Charts by Vincent J Gallo



UNIX INTEREST PIQUED

Based on responses to: "Please check those of the following that were/will be important to your information systems planning."

Figure 3

DECISIONS charts

CAPACITY INDEX

Based on responses to: "Which percentage best describes the utilization of your total mainframe and minicomputer capacity?"

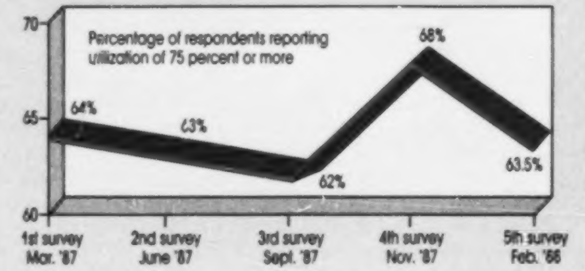


Figure 4

DECISIONS chart

ing with its Personal System/2 microcomputers. IBM has been marketing the architecture aggressively, saying buses based on it are faster and more functional than earlier alternatives, and are better able to take advantage of Operating System/2's multitasking features.

Survey respondents aren't anywhere near as sure about the importance of Micro Channel as they are about OS/2. About 12.5 percent of respondents to a question about information systems planning factors said Micro Channel will be important to their planning over the next 12 months. That's a percentage point less than the response to the same question on the previous survey—indicating interest is flat. However, 47 percent of the respondents to the planning question said OS/2 will be important to their planning for the next year. That's more than triple the number who said OS/2 is important to current planning (13 percent).

It's reasonable to conclude from these responses that IBM hasn't yet established a strong link between OS/2 and Micro Channel (read that, PS/2). The survey results indicate strong plans to purchase IBM's PS/2s. Fifty-five percent of respondents to a question about micro spending plans said they plan to buy PS/2s during the next 12 months, up from 43.5 percent on the previous survey. However, the results don't break out Micro Channel-based PS/2s and AT-bus models.

IBM's strength in micros is rivaled by Compaq Computer Corp. and other clone makers. One quarter of the respondents to this question said they will buy from Compaq this year; even more plan to buy from other micro makers. And looming on IBM's horizon is Apple Computer Inc., which got high marks from respondents to the fifth survey, improving on strong performances on earlier surveys.

Nevertheless, Apple has had a hard time translating its high ratings on our surveys into equally large leaps in purchasing plans. The fifth survey is no exception. Forty-three percent of respondents to the question about spending plans for specific vendors said their Apple spending will increase (up from 34.5 percent on the fourth survey). However, on the question asking which micro vendors respondents will buy from this year, 19 percent of respondents checked off Apple—only a percent more than said they already buy from Apple.

Apple's recent lawsuit against Microsoft Corp. and Hewlett-Packard Co., seeking to halt development of a Macintosh-like interface for OS/2-based systems, was filed after the fifth survey was conducted. Paine Webber's Therrien believes respondents to the next survey—the sixth in our series—may excoriate Apple for filing the suit.

The big surprise in the Vendor Popularity Index for the fifth survey: Lotus Development Corp. (Cambridge, MA) took a dive. Of respondents to the general opinion question, 13 percent said their opinion of Lotus had changed for the worse during the quarter, only 3 percent less than said their opinions had changed for the better. Paine Webber's Robert Therrien believes the responses indicate the split of opinion among MIS managers about Lotus. There's lots of pent-up demand for Lotus's soon-to-ship third version of its 1-2-3 spreadsheet software. However, new product delays have never endeared vendors to users, and Version 3 of 1-2-3 is late, Therrien notes. **D**

THE SURVEY: HOW AND WHO

The fifth DECISIONS/Paine Webber Survey of MIS Attitudes continues a series of quarterly surveys cosponsored by DECISIONS and Paine Webber Inc., the Wall Street brokerage house. The survey was conducted during the last week of February and the first two weeks of March 1988.

Questionnaires were mailed to 10,000 DECISIONS subscribers with MIS management titles. Excluded from the sample, however, were MIS managers in organizations whose primary business is marketing computer equipment and software.

A total of 1,099 questionnaires were returned, a response rate just shy of 11 percent. SPSS Inc., a Chicago-based statistical software house that advises DECISIONS and Paine Webber on the survey, sets the survey's margin for error at 2.5 percent. SPSS tabulated results of the survey using its SPSS-X package for VM/CMS.

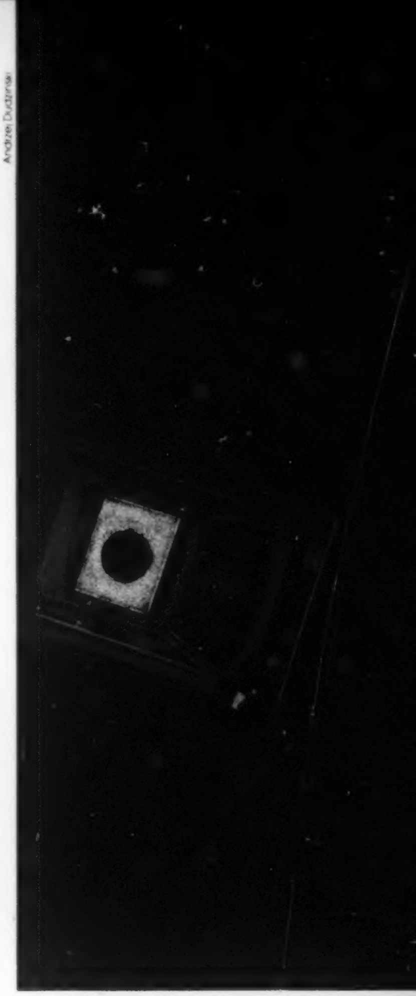
The survey's respondents represent MIS managers in large corporations. Of the respondents, 36.5 percent have IBM 3090 mainframes in their organizations. One quarter have IBM System/3X minicomputers. Thirty-five percent have DEC VAXs; 8 percent have IBM 937X midrange processors. Just under one-third of the respondents are responsible for or involved in the purchase of long-distance services. The largest group of respondents—30 percent—hails from manufacturing corporations. Government is the next largest group, at 17 percent, and insurance/financial services ranks third, at 12.5 percent.

MIS IN TRANSITION, PART III

DETROIT'S COUNTERATTACK STRATEGY

To fight back against imports, MIS departments in the auto industry share a common goal: Get cars to market faster.

by Paul Eisenstein


Andrzej Dudzinski

What is probably the most advanced example of computer-integrated manufacturing can be found in the Pontiac East assembly plant of General Motors Corp.'s Truck and Bus Group. It's no accident. The competitive squeeze exerted by Japanese and South Korean automakers has forced U.S. car manufacturers to face a stark reality: Automate or die.

Many U.S. manufacturers face a similar threat from foreign competitors, but the auto industry leads in the aggressive application of enterprisewide information systems solutions to that threat. The challenge: Get products to market faster. Meeting the challenge requires the concerted efforts of MIS pros cutting across organizational lines—from engineering to manufacturing to distribution. Systems at each stage of the process must be implemented with the next stage in mind if the challenge is to be met.

To that end, MIS is implementing and, most importantly, integrating a vast array of state-of-the-art automated systems. On the Pontiac East (MI) plant's 2.4-million-square-foot assembly line are 143 robots, many of them built into 25 assembly cells performing a variety of production operations for two- and four-wheel-drive vehicles. Robots from GMF Robotics Corp. are linked to Allen-Bradley Co. programmable controllers, which are linked to Hewlett-Packard Co. HP 9000 cell controllers, which are linked to Digital Equipment Corp. VAX area controllers, which are linked to IBM mainframes. All are integrated via Manufacturing Automation Protocol, a standard set of communications protocols based on the Open Systems Interconnection seven-layer model.

General Motors' investment in MAP—$2.6 billion to develop and implement MAP at the Pontiac East plant and four other factories—is one of the most significant aspects of the more than $40 billion it has pumped into factory automation and related information systems so far this decade. The automaker believes the money has been well spent. "It's unbelievable what the long-range savings can be," says Ernest O. Vahala, director of manufacturing engineering operations at GM Truck and Bus. The cost of computer communications systems can be reduced by 30 percent or more, he says, because they can all communicate via MAP devices rather than using proprietary equipment. More significantly, Vahala says, MAP allows factory engineers to use flexible automation systems that can quickly be reprogrammed to adapt to changes in vehicle or component design.

Such investments—and the changes they bring—are vital to the survival of the American auto industry. Since the late 1970s, U.S. automakers have been locked in a struggle for market share. Imports, especially those from Japan, have gobbled up roughly a third of the American new-car market.

Although the rising yen has been leveling off Japan's production cost advantage, that country's factories still are generally more efficient than those run by the Big Three—General Motors, Ford Motor Co., and Chrysler Corp.—often operating with half the manpower and far more automation. Manufacturers in South Korea, where labor costs are minuscule and exchange rates have remained relatively stable, enjoy an even greater cost advantage over domestic automakers.

GM is not alone in investing billions in response to competitive pressures. At least some of the credit for Chrysler's acclaimed turnaround must go to the $10 billion it invested in automation systems that have al-

lowed its older assembly lines and component plants to improve quality and productivity. Ford has invested about $20 billion over the last five years to upgrade its products and plants. The Big Three are also promoting—and in many cases demanding—the implementation of such systems by suppliers and dealers.

In its effort to come to grips with its growing reliance on automation and information systems, General Motors in 1984 reached for outside help. In a stunning move, GM spent more than $2 billion to acquire Dallas-based Electronic Data Systems. Thousands of GM computer and data processing employees were transferred to EDS, while EDS transferred several thousand of its employees from Texas to Detroit and began hiring thousands more from the Motor City area.

The transition was nowhere near as smooth or swift as expected, but the process is falling into place. EDS now serves as a central leader of a vast and previously not very well integrated computer network. It also serves as a linchpin in the overall effort—symbolized by MAP—to link all the components of GM's computer network, from executives' microcomputers to factory-floor systems.

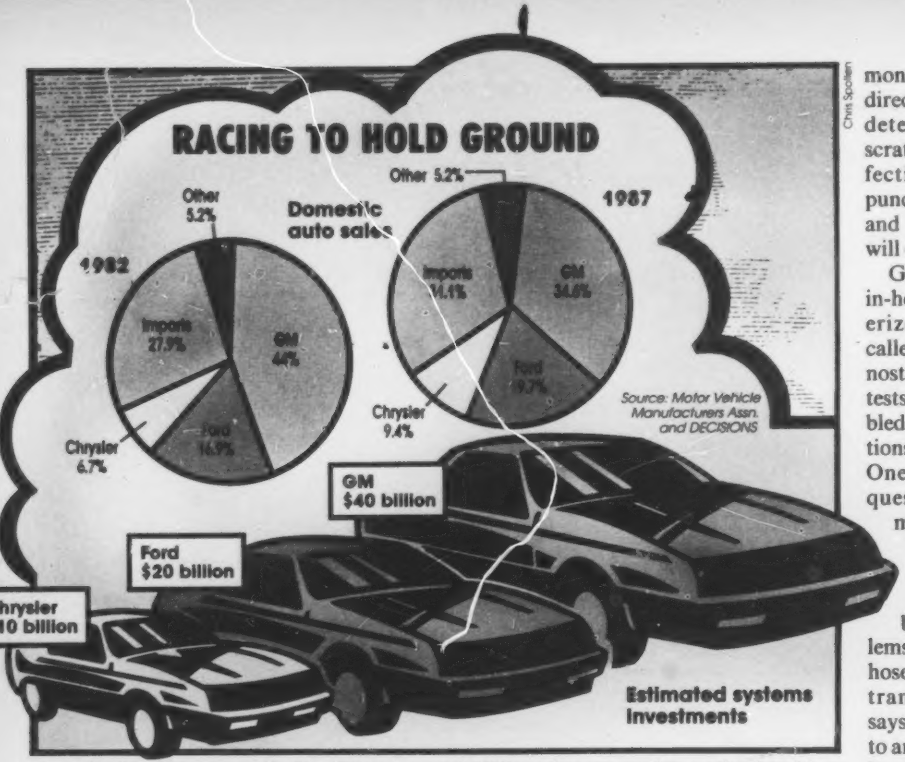
A similar need to update, integrate, and centralize information and automation systems is responsible for Ford's growing and as yet not fully defined relationship with IBM. So far, IBM has been providing hardware and advice on Ford's expanding use of automation. It is still unclear, however, just how far this relationship will go. Some of the work is being handled by IBM affiliates. One such affiliate, Measurex, is slowly adding a network of IBM 937X processors to help link the automaker's factory-floor and office systems.

Streamlining with MIS

Information systems and automation aren't the industry's only answer to today's competitive challenge; the automakers have also downsized their work forces to become more responsive and flexible to shifts in market demand. MIS is essential in making these new, leaner organizations function effectively—beginning with product design and development.

Cutting product development time is key to the success of U.S. automakers' automation efforts. Today, the typical lead time for a new American car model is five years. Japanese car manufacturers typically can design an entirely new vehicle and bring it to market in less than four years. Honda's lead time is down to 40 months, and its goal is three years.

"We are moving into an age of highly automated manufacturing," says Jerry Barnes, manager of engineering systems at Chrysler. "If products are going to be manufactured using these automated systems, they have to be designed that way. We can design a product using computer-aid-



Source: Motor Vehicle Manufacturers Assn. and DECISIONS

Chris Spollen

Over the last five years, the Big Three invested billions in automation and related information systems to curb penetration of domestic markets by Japanese and other imports—and still lost ground. To maintain market share, those systems must now be honed to further cut the design-to-market cycle.

ed methods that will transfer intact to the manufacturing environment, allowing for what we estimate to be a 40 percent decrease in product development time. That will bring products onto the market in three years."

Such systems allow designers and engineers to modify designs quickly. "Our vision is to one day be able to do even initial sketches on the computer," says Chuck Jordan, vice president of General Motors' design staff. "We'll be able to take the sketch and evaluate it, define the surfaces, change the light source, rotate the vehicle." Jordan says GM has a contract with the Massachusetts Institute of Technology under which a system is being designed that will take digital information and produce a full-size hologram. "We call it 'The Studio of the Future,' and we've got one studio dedicated to it," he adds.

All of the Big Three are implementing, to some extent, systems incorporating design-for-manufacturing concepts—designing with manufacturing requirements in mind from the very start of the project. Designers can quickly estimate the cost of producing machined parts, speeding design time and lowering manufacturing costs. Ford credits these systems with reducing manufacturing labor costs by as much as 80 percent and material costs by as much as 40 percent.

While most of the automotive design and engineering work today is being done on micros and minicomputers, speeding up the design process is one of several reasons that the Big Three have invested in supercomputers. Supercomputers are used to simulate tests done in wind tunnels, speeding up the development of aerodynamic shapes; they also simulate crash tests.

Lemon control

Designing for manufacturing improves part quality as well, an integral aspect of speeding products to market. Several years ago, Chrysler developed its Performance Feedback (PFB) quality control system to check cars as they roll along the assembly line. PFB, which runs on an IBM 4381 processor, is in use in Chrysler plants in Sterling Heights, MI, Belvidere, IL, and St. Louis. "PFB ensures that when the car comes off the line, it's built correctly," says Nick Simonds, Chrysler's executive director of MIS. "If a worker detects a problem, like a scratch in the paint or a defective part, it can be punched into the computer, and someone down the line will check and correct it."

General Motors uses an in-house-developed computerized diagnostics system called Assembly Line Diagnostic Link (ALDL), which tests fully or partially assembled vehicles at various stations in the assembly plant. One GM official, who requested anonymity, estimates that before using ALDL, as many as 15 percent of the company's new cars were being shipped with problems ranging from missing hoses to defective engines or transmissions. Today, he says, that figure has dropped to around 2 percent. "No test is perfect," observes Rick Knoth, a GM engineering group manager instrumental in implementing ALDL, "but without ALDL, we'd have significantly more cars in customers' hands not operating correctly." As with its other automation systems, GM has designed ALDL to interface with MAP.

Ford and Chrysler also are keeping close watch on the development of MAP, but their commitment to the protocol is far less certain at this point. Since retooling its Windsor, Ontario, mini-van plant in 1981, Chrysler has worked toward a goal of interconnectivity, says Frank E. Plonka, a manager in Chrysler's Technical Systems Division for Advanced Manufacturing Operations. Chrysler has based much of its factory automation on Milwaukee-based Allen-Bradley's Data Highway, developing "a proprietary Factory Information System unique to our company," Plonka says. "We have a system of local-area networks from third-party suppliers tying together our programmable controllers," he explains. "We have written custom code to hook them all together." It took seven employees about a year to design the original system, he says. Each update has taken from six to nine months. "Chrysler does support and will continue to support the MAP standard," Plonka adds, "but so far we have not made use of it in any of our facilities. We plan on converting to MAP when we feel it makes sense for us to do so."

Ford has begun implementing MAP in its factories; it has already converted to MAP at its Rawsonville components facility in suburban Detroit, and in its Dagenham, England, engine plant. "A lack of standards would mean that we would have a major hurdle to overcome in our search for efficiency of operation," says Jim Cnossen, manager of manufacturing systems and operations research. He points out that Ford is represented on the national MAP steering committee, and has an internal committee set up to stay abreast of developments. "We have planners working on MAP implementations, and we continue to support MAP efforts," Cnossen says. "As we install new equipment in our facilities, we are continuing to position ourselves into MAP."

Essential connectivity

Whether or not MAP ultimately becomes the dominant industrywide standard, interconnectivity is essential at a variety of levels, these managers agree. And that's not limited to confines of the factory, as suppliers to the Big Three begin to take on a larger role in participating in part design and engineering. Ford, for example, has essentially turned over all door latch design and manufacturing to a Canadian manufacturer, Magna International. Electronic data interchange, the computer-to-computer exchange of documents like purchase orders and shipping notices, expedites the process.

By the early 1990s, industry analysts predict, virtually all of Detroit's auto assembly plants will be receiving their inventory on an as-needed basis. According to a study by the Auto Industry Action Group, a Southfield, MI, trade association, only 10 percent of those suppliers surveyed in 1981 said they received most of their material releases from the Big Three electronically. In the most recent AIAG survey, conducted two years ago, that had grown to 54 percent, and the figure is now believed to be substantially higher.

The Big Three are also adopting just-in-time manufacturing techniques, in which parts may be delivered to a factory sometimes minutes before assembly. JIT reduces labor, inventory, and other warehousing costs, and can lead to improved quality control. A philosophy rather than an automation system, JIT methods are being incorporated into many manufacturing planning and scheduling systems. JIT requires that an automaker keep tight control of its production schedule and that such details be accurately transmitted to its suppliers, which in turn must ship the right number of components needed at the factory at any given time.

For example, every day Chrysler assembly lines turn an assortment of 38 million parts into nearly 9,000 cars and trucks. Until recently, the typical Chrysler plant had several months' worth of components in its warehouse. In 1981, the typical Chrysler assembly line turned over its inventory no more than 16 times a year. Today, the average is 54 turnovers annually—more than once a week. And the goal is once every five days, says Richard E. Dauch, Chrysler's executive vice president of manufacturing.

The primary factor behind that improvement is the JIT system introduced at Chrysler's refurbished Windsor plant in late 1983. The system lets the automaker closely track its production plans and then precisely order components from its 2,300 material suppliers. "We very carefully communicate our requirements to suppliers and give them a very disciplined schedule that does not

DETROIT MIS: BEYOND HIGH TECH

Courtesy Chrysler Motors

A consistent direction is as key to MIS success as any technology, says Chrysler's Nick Simonds.

You might expect the office of the executive director of MIS for Chrysler Corp. to be a high-tech wonderland—after all, last year Chrysler spent about a quarter of a billion dollars on information systems. But if Nick Simonds decides to go online, he has to log on from someone else's office. Right now, he says, managing people is a far more important part of his job than managing technology.

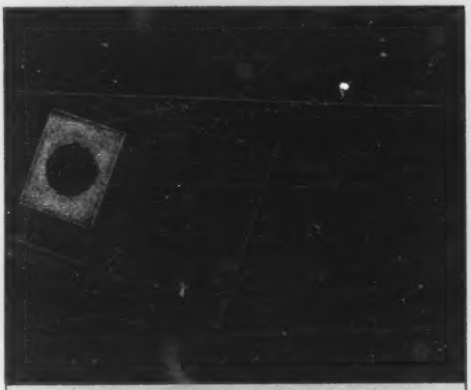
"If all I had to do was work with technology, I'd only work half a day," says Simonds. "There's not one problem I don't have a technical solution for. It's getting agreement on direction and consistency that's important. Most information systems cross organizational boundaries, so you get caught up with each group wanting to do things its own way."

Managing technology will always be part of the job, however. Major advances in automation systems are imminent for the auto industry, Simonds says, citing machine vision as one example. But, he adds, Chrysler and its competitors have yet to make the best use of the technology already available to them. "It's not purely a matter of technology," he explains. "It's how we apply it. Get consistency in direction, keep it up, and then get your best people in there."

Simonds joined Chrysler in 1984 after working for National Intergroup in Pittsburgh and Inland Steel in Chicago. He directs the planning, development, and implementation of information systems comprising three computer centers with about 1,000 employees and more than 30,000 microcomputers and terminals.

Simonds begins his typical work day before 7:30 a.m. He is an avid squash player, and several days a week he can be found working up a sweat during lunch hour at a court in the recreation area of Chrysler's K.T. Keller management building. He lives in Grosse Pointe, MI, with his wife, Nanne. Their son and daughter are college students. In his leisure time, Simonds enjoys skiing, reading, and Saturday morning platform tennis. "I'm really unprogrammed outside of work," he says.

change," Dauch says. "Then they can predict what they need to deliver in terms of volume, mix, color, or option so accurately that we have had very few crises." Ford and GM have also adopted JIT, particularly in newer plants.



'We went through automation for automation's sake. The key word now is simplicity.'

The role of information systems in the auto industry is not limited to design, engineering, and manufacturing. The Big Three are also implementing systems in their distribution networks. Ford recently created a new Marketing Systems and Communications Office to oversee the implementation of a far-reaching, five-year dealer services program that will be based on more than $2 billion worth of IBM hardware. Chrysler recently connected all of its 4,000 North American dealers through the Dealer Information Access Link (DIAL II) system; that network will soon be linked to the 2,000 additional dealers acquired by Chrysler when it took over American Motors Corp. last year. "We use IBM PC ATs linked to corporate mainframes to connect the dealers to place car and parts orders, check warranty claims and order status, and get service bulletins and electronic mail," Nick Simonds says.

According to Simonds, DIAL II was put in place to "to make it quick and easy for a dealer to do business with us. We're hoping to tie it into our financial subsidiary soon so that a salesperson can get loan approval right on the floor with the customer there," he adds. General Motors has taken a number of similar steps, and has even been using its remote satellite distribution system to improve ties to its more than 10,000 U.S. dealers.

U.S. automakers are also beginning to use what one GM engineer describes as "a mechanic in a box." Two years ago, Ford launched its Online Automotive Service Information System (OASIS), which assists dealer service technicians with the diagnosis and repair of difficult problems. OASIS now processes more than 10,000 calls daily. Similar systems are in development at Chrysler and GM.

Despite the wide variety of information systems in use throughout the auto industry, the rate of implementation is currently an issue of uncertainty. In some cases, technology has not been developed as quickly as anticipated. In other instances, budget cuts have forced nonessential applications to be delayed or scrapped altogether. Indeed, if the U.S. economy goes into a recession in the next year or two, as some predict it will, there could be some sizable cutbacks in automated and information systems spending in the auto industry.

Thus far, the sharpest cutbacks have hit vision and robotics systems. According to Dataquest, a San Jose, CA, market researcher, the Big Three accounted for 54 percent of all robotics sales in the United States in 1986. This year, that share may fall below 44 percent. Much of the slowdown has been the result of budget cutbacks at General Motors. GM's capital spending totaled $10.6 billion in 1986. It dipped to about $7.9 billion last year, and will decline to $5.9 billion by 1989. Much of that reduction is the result of the delay or cancellation of high-tech systems.

By last fall, General Motors had installed 6,400 robots, and had another 1,100 on order. A few years ago, General Motors forecast it would have 10,000 robots on line by the end of this year. Now, that target won't be hit until the early 1990s.

The cutback in capital spending is not the only reason GM is scaling back its use of robotics, however. The company's forays into robotics haven't been resounding successes. For example, GM's Lake Orion plant in suburban Detroit, dubbed its "factory of the future," boasted 157 robots and a host of other automated devices when it first went into operation in 1984. Company officials proudly boasted that the plant would provide the best quality and productivity of any GM plant. Instead, the $650 million assembly line has turned into one of GM's biggest headaches, with productivity and quality among the automaker's lowest. At 3.7 million square feet, the factory is double the size of most auto plants, and with 6,700 workers, it has nearly triple the work force of the New United Motor Manufacturing Inc. assembly line, which GM runs jointly with Toyota. NUMMI produces roughly the same number of cars with less than half the automation.

"We went through a phase of automation for automation's sake," says William Hoglund, executive vice president in charge of the Buick-Oldsmobile-Cadillac "large car" group. "The key word now is simplicity. The automation has to be pretty straightforward."

Such lessons have not been lost on GM's competitors. "You will see a continuing trend in our company against putting massive amounts of money into hard automation, but rather to spend it on automation that keeps our facilities working at maximum capacity and efficiency," says Rex Greenslade, a Ford spokesman.

For the Big Three, times have irrevocably changed. When they competed only with one another, there was little impetus to make striking changes in manufacturing methods and systems. The globalization of the auto industry has changed the ground rules. To achieve the gains the automakers need to make in terms of productivity, quality, and profitability requires fundamental changes in the way they operate. A combination of management changes and integrated systems may be the only answer. **D**

Paul Eisenstein is a free-lance writer based in Pleasant Ridge, MI.

COMPUTER DECISIONS

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THE POLITICS OF UNIX

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COMPUTER DECISIONS

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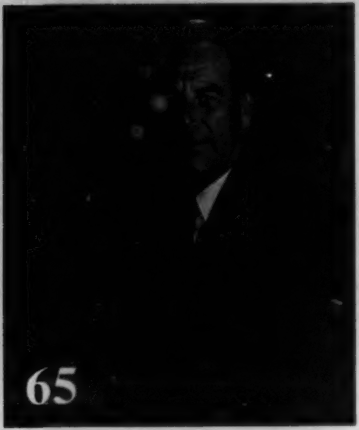

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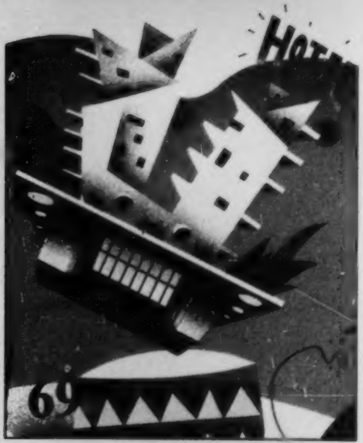

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EDITOR'S MESSAGE

Magnificent Seven?

People in the outside world don't believe me when I tell them how information technology standards are established—such as in the case of the Open Software Foundation and Unix. For instance, they don't believe seven CEOs from major American and European companies who battle one another in the marketplace 364 days a year can suddenly walk into a room, throw $90 million on the table and proclaim, "By God, we're in this thing together."

I have trouble with this myself. But as you'll read on page 55 of this issue, thanks to senior editor John Soat's diligent rendering of a story project that began months ago, the stage has been set for the premiere of the Open Software Foundation—or something like it—for some time. There was even a villainous, despotic alliance, cast right out of *Star Wars.* This goes to press while the AT&T/Sun partnership's response to OSF, whatever it will be, is still in the boost phase. However, the interim is perfect for savoring the vignette of IBM chief John Akers's attempt to look inconspicuous at the OSF press conference, sitting up there among the righteous offended. Give him credit—this is perhaps the one role IBM managers have never rehearsed.

Akers was really there to drop the other shoe. Few paid much attention when the first one dropped in February, giving shape and a time line to IBM's strategic development plans for AIX, its Unix variant. However, IBM executive vice president Alan Krowe, who answers only to Akers, happened to be speaking at an IBM-sponsored meeting of telephone company information managers in Florida on the occasion of the AIX announcement. Krowe informed his audience that the "two worlds of SAA and Unix" would dominate the operating environments of the '90s. Krowe even went so far as to envision an "85 percent similarity" in user interface screens between the SAA and Unix environments. While IBM's press relations contingent later took pains to point out the "personal" nature of Krowe's vision, one got the impression that it was hardly an impromptu flight of fancy.

Now AIX is the core for OSF's development activities. I guess the moral is: If you need help getting across the street, hire a Green Beret.

Robin Nelson

Cover Illustration:
Bryan Haynes

PERFORMANCE REPORT

THE SOUND AND FURY OF FUTURES

Last year, most large-systems players concentrated on getting ready for the future. For some, that future is close at hand.

by Robert Moran

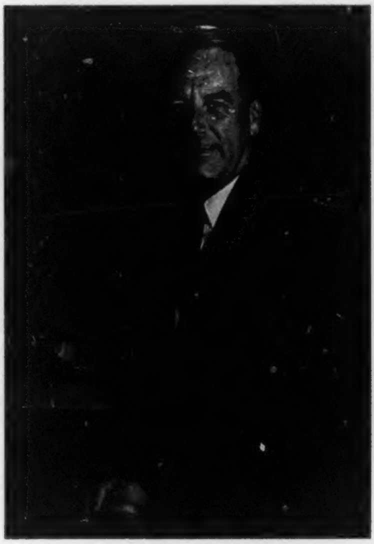
The excitement emanating from the large-systems arena in 1987 centered primarily on platforms and products holding more promise for the future than utility for the present—witness IBM's Systems Application Architecture, the Macintosh-to-VAX link of Apple Computer Inc. and Digital Equipment Corp., and the foray by Hewlett-Packard Co. into RISC technology. The fact that large-systems leaders pumped more resources than usual into research and development last year added to the "futures" bent of the market.

In preparing for the years to come, however, systems and peripherals makers didn't forsake the present. Few vendors starved; some grew modestly, and a couple even prospered royally. Among the top performers last year in the large-systems market was DEC, which rode a 23 percent increase in revenues to overtake Unisys Corp. as the number-two supplier of large computer systems, according to DECISIONS' annual market survey. DEC, which is second only to IBM now, showed profits of nearly $1.3 billion. Although DEC's first-quarter performance this year was flat, analysts expect the company to pick up the pace with its new VAX 6200 series.

DEC's strong performance did little to shrink the huge gap between IBM and the rest of the pack, however. Despite only a 6 percent revenue increase over 1986, IBM managed to garner more than $5.2 billion in profits, even after massive R&D and operating expenditures.

IBM's performance came as no surprise to industry analysts. Bob Djurdjevic, president of Annex Research (Phoenix) and a DECISIONS columnist, expected 1987 to be IBM's "trough year," principally because John Akers, IBM's chairman and CEO, inherited what Djurdjevic calls the massive overexpansion of the 1980s. Last year, Akers began to make his presence felt, cutting back expenditures and reversing policies and trends set by his predecessors. Djurdjevic adds that IBM's 6 percent growth in 1987 may be misleading. According to him, IBM made a substantial inventory write-off in the fourth quarter of 1986, which negatively affected earnings for that year. In Djurdjevic's estimation, IBM's business in 1987 was essentially flat, if not slightly down, compared with 1986.

IBM's presence is implied in all three categories of DECISIONS' large-systems and peripherals survey. In the survey, each company is ranked by total data processing revenues and placed within the category that yields its largest dollar volume. Plug-compatible manufacturers reach into other categories as well, although collectively they represent only 15 percent of IBM's share in any given market.


Courtesy Hewlett-Packard

HP CEO John Young

Last year, HP spent $900 million, or 14 percent of its revenues, on research and development.

PCMs in the news

Among the PCMs, three major stories unfolded last year. Amdahl Corp. showed outstanding revenue growth. Memorex Corp. and Telex Corp. merged to create the largest of the PCMs. And Storage Technology Corp. emerged from serious financial troubles with relatively respectable profits of $26 million.

According to Djurdjevic, Amdahl, on the strength of a 28 percent growth in revenue, became only the second PCM ever (Storage Technology was the first) to operate at a 10 percent profit margin. Amdahl's success can be attributed to the fact that 1987 was the first year that it shipped its mainframes in full volume, as well as to prudent cuts in manufacturing expenses, says Djurdjevic. One way that Amdahl keeps its R&D costs down is by sourcing its disk drives from Japanese manufacturer Fujitsu Ltd. However, Joseph Zemke, Amdahl's president, notes that the company has spent 12 percent to 17 percent of its revenue on R&D over the last five years, and that last year it spent $150 million on R&D. According to James Porter, president of Disk/Trends (Mountain View, CA), disk drives represent slightly under 30 percent of Amdahl's sales.

Courtesy Storage Technology Corp

StorageTek CEO Ryal Poppa

> ***StorageTek is 'betting the ranch' on the success of its ACS storage library, according to Poppa.***

Xerox Corp.'s continued domination of the peripherals market notwithstanding, the big news among peripherals makers was last November's merger of Memorex and Telex, which last year ranked second and third, respectively, in that market segment. Memorex itself reached the $1 billion plateau in revenue, a 10 percent increase over its 1986 performance. Telex showed 14 percent growth, with a little over $846 million in revenue.

The newly merged company, known as Memorex Telex, is now the largest of the PCMs. Telex brings to the partnership a booming business in terminals—it was ranked fourth among U.S. terminal makers by International Data Corp. (Framingham, MA). Memorex's strength lies in one of the richest segments of the industry: the disk drive business. Like Amdahl, Memorex spares itself some R&D expenses and has very little manufacturing costs associated with disks; its drives are built with head disk assemblies manufactured by Unisys. Although Memorex's revenues grew by 10 percent, Disk/Trends' Porter says the company's performance continued to be hurt by reliability problems it encountered two years ago with its drives.

Although Storage Technology garnered only an 8 percent revenue growth over 1986, Djurdjevic calls it the industry's phoenix. StorageTek, as the vendor calls itself, emerged from Chapter 11 status to turn a modest profit. The vendor refocused its business into what Ryal Poppa, chairman and CEO, calls information storage. StorageTek's business is now focused on solid-state disks, rotating magnetic disks, tape drives, and high-speed printers.

But the vendor is pinning its biggest hopes on its storage library, the 4400 Automated Cartridge System (ACS). StorageTek is "betting the ranch" on the ACS, says Poppa. The ACS, which didn't contribute a cent to StorageTek's 1987 profits, gobbled a little more than half of the 8.5 percent of revenues the vendor pumped into R&D. The remainder was allocated to tape and disk products, which Poppa says contributed the most to StorageTek's profits. The ACS and the new 18-inch Model 4480 tape cartridge stimulated sales for the older nine-track half-inch reel-to-reel tape, the Model 4670. Poppa claims that there was a perceived "mutuality" between all three products.

StorageTek's commitment to the ACS may pay off. According to James Porter, a new triple-capacity IBM 3380-type disk drive (which required about an 8 percent R&D investment), the 4480 cartridge drive, and the library could spell a strong 1988 for StorageTek. Poppa plans on it. Revenue per employee in 1987 was slightly over $90,000, a minimum of $20,000 lower than industry leader IBM. "By the end of 1988, we'll show $100,000 per employee," Poppa asserts.

The R&D wave builds

Like StorageTek, Hewlett-Packard boosted its R&D efforts in 1987. The vendor continued to hold the fifth slot among processor vendors in the DECISIONS survey, showing a 13 percent growth in revenues over 1986. Hewlett-Packard spent $900 million, or 14 percent of its revenues, on R&D last year. The two biggest reasons: its Precision Architecture, based on RISC (reduced instruction set computing) technology, and New Wave, a package for distributed microcomputer environments. According to Bill Murphy, HP's director of marketing and business systems, HP usually invests 10 percent of revenues in R&D, but "saw the opportunity to make a leap in technology." Precision Architecture, he says, "will provide reliability and cost of ownership advantages through the end of the decade."

HP also channeled R&D funds into two other areas: its suite of communications products, which are based on Open System Interconnection standards, and productivity improvements. According to Murphy, HP implemented a corporatewide product improvement platform for its sales force. The program ties all sales personnel to online databases containing data on the availability of products and system configurations for orders.

No doubt Hewlett-Packard is taking these steps to prepare for an aggressive run at DEC. HP is aiming its RISC-based Series 955 minicomputer and right at DEC's high-end VAX 8800 models (see Systems & Peripherals Technology Trends, page 50). The Series 955 processor won't be available until the first half of next year, however.

A newcomer to DECISIONS' peripherals

'87	'86	Processors	'87 Revenues (000)	'86 Revenues (000)	Percent Growth	Total '87 Revenues (000)	Total '87 Profits (000)
1	1	IBM *(Armonk, NY)*	52,100,000 (E)	49,300,000 (E)	6	54,217,000	5,258,000
2	3	Digital Equipment Corp. *(Maynard, MA)*	10,391,160	8,414,246	23	10,391,160	1,284,321
3	2	Unisys Corp. *(Detroit)*	9,712,900	9,100,100*	7	9,712,900	578,000
4	4	NCR Corp. *(Dayton, OH)*	5,075,667	4,377,588	16	5,640,667	419,330
5	5	Hewlett-Packard Co. *(Palo Alto, CA)*	4,488,000 (E)	3,950,000 (E)	13	8,100,000	644,000
6	6	Control Data Corp. *(Minneapolis)*	3,366,500	3,346,700	1	3,366,500	19,300
7	7	Wang Laboratories Inc. *(Lowell, MA)*	2,847,600	2,668,900	14	3,047,600	94,500
8	8	Honeywell Bull Inc. *(Minneapolis)*	2,060,000	1,900,000	8	2,060,000	17,400
9	9	Data General Corp. *(Westboro, MA)*	1,288,900	1,287,600	1	1,303,900	(92,000)
10	10	Amdahl Corp. *(Sunnyvale, CA)*	1,234,381	966,349	28	1,234,381	145,985
11	12	Tandem Computers Inc. *(Cupertino, CA)*	1,079,742	837,972	29	1,079,742	102,200
12	11	Prime Computer Inc. *(Natick, MA)*	960,913	860,173	12	960,913	64,768
13	13	Texas Instruments Inc. *(Dallas)*	895,120 (E)	946,600 (E)	-5	5,594,500	308,500
14	14	National Semiconductor Corp. *(Santa Clara, CA)*	800,000 (E)	700,000 (E)	14	2,067,600	6,600
15	15	Cray Research Inc. *(Minneapolis)*	687,336	596,685	15	687,336	147,076
16	16	Harris Corp. *(Minneapolis)*	446,000	464,000	-4	2,100,128	92,204
17	19	MAI Basic Four Inc. *(Tustin, CA)*	334,200	287,857	16	334,200	24,830
18	17	Datapoint Corp. *(San Antonio, TX)*	310,842	322,776	-4	310,842	(52,411)
19	18	Gould Inc. *(Rolling Meadows, IL)*	290,000 (E)	300,000 (E)	-3	933,400	(95,600)
20	20	Recognition Equipment Inc. *(Irving, TX)*	264,658	241,795	9	264,658	13,814
21	21	Concurrent Computer Corp. *(Tinton Falls, NJ)*	240,490	218,849	10	240,490	10,266
22	25	Stratus Computer Inc. *(Marlboro, MA)*	184,150	124,559	48	184,150	19,395
23	22	NBI Inc. *(Boulder, CO)*	174,288	186,837	-7	261,454	(16,471)
24	23	Altos Computer Systems *(San Jose, CA)*	168,291	139,461	21	168,291	14,428
25	28	Computer Consoles Inc. *(Rochester, NY)*	148,394	129,557	15	148,394	11,320
26	—	CPT Corp. *(Minneapolis)*	102,645	103,719	-1	102,645	(31,043)
27	—	Symbolics Inc. *(Cambridge, MA)*	101,564	112,588	-10	101,564	(23,377)
28	—	Floating Point Systems Inc. *(Portland, OR)*	84,269	88,579 (R)	-5	84,269	(29,241)
29	—	Qantel** *(Hayward, CA)*	82,533	N/A	N/A	82,533	9,358
30	—	Teradata Corp. *(Los Angeles)*	61,580	31,357	96	61,580	6,916
		Total Processors	100,184,118	92,020,847	9		
		Processors without IBM	48,084,118	42,720,847	13		

*pro forma figure **formerly Mohawk Data Sciences Corp.

'87	'86	Peripherals	'87 Revenues (000)	'86 Revenues (000)	Percent Growth	Total '87 Revenues (000)	Total '87 Profits (000)
1	1	Xerox Corp. *(Stamford, CT)*	2,200,000	1,890,000	16	15,125,000	578,000
2	2	Memorex Corp.* *(Santa Clara, CA)*	1,000,000	906,000	10	1,000,000	N/A
3	3	Telex Corp.* *(Tulsa, OK)*	846,683	741,621	14	846,683	N/A
4	4	Storage Technology Corp. *(Louisville, CO)*	750,028	696,009	8	750,028	26,006
5	—	Alcatel Business Systems Group *(San Jose, CA)*	500,000	N/A	N/A	500,000	N/A
6	9	Wyse Technology *(San Jose, CA)*	388,735	234,750 (R)	66	388,735	25,331
7	10	National Computer Systems Inc. *(Minneapolis)*	203,700	197,610	3	203,700	23,947
8	5	Decision Industries Corp. *(Horsham, PA)*	191,400	196,083	-2	191,400	(23,300)
9	6	Bell & Howell Inc. *(Skokie, IL)*	179,200	239,700	-25	726,869	61,365
10	—	EMC Corp. *(Hopkinton, MA)*	127,066	66,588	91	127,066	28,241
11	12	System Industries Inc. *(Milpitas, CA)*	121,264	109,308	11	121,264	4,800
12	11	[illegible] Data Corp. *([illegible], NY)*	105,284	109,443	-4	105,284	(3,436)
		Total Peripherals	6,613,360	5,386,112	23		

*merged in November 1987 to form Memorex Telex

'87	'86	Scientific & Engineering	'87 Revenues (000)	'86 Revenues (000)	Percent Growth	Total '87 Revenues (000)	Total '87 Profits (000)
1	3	Sun Microsystems Inc. *(Mountain View, CA)*	758,900	342,700	121	758,900	48,000
2	1	Intergraph Corp. *(Huntsville, AL)*	641,083	605,737	6	641,083	69,876
3	7	Lockheed Corp. *(Calabasas, CA)*	640,000	386,000	66	11,321,000	421,000
4	2	Computervision Corp.* *(Bedford, MA)*	564,028	494,672	14	564,028	19,480
5	4	Apollo Computer Inc. *(Chelmsford, MA)*	553,660	391,685	41	553,660	21,692
6	5	Tektronix Inc. *(Beaverton, OR)*	476,843	517,100	-8	1,388,853	25,677
7	8	Gerber Scientific Inc. *(South Windsor, CT)*	239,349	209,075	14	239,349	25,516
8	—	Silicon Graphics *(Mountain View, CA)*	115,969	59,340	95	115,969	11,916
9	9	Daisy Systems Corp. *(Mountain View, CA)*	103,538	95,956	8	103,538	(13,970)
10	—	Convex Computer *(Richardson, TX)*	69,647	40,200	73	69,647	8,845
11	10	Valid Logic Systems Inc. *(San Jose, CA)*	66,586	60,907	9	66,586	(25,905)
12	—	Alliant Computer Systems Corp. *(Acton, MA)*	53,798	30,764	75	53,798	6,851
		Total Scientific & Engineering	4,280,391	3,234,136	32		

*merged recently with Prime Computer Inc. (E) Estimated (R) Restated Annual revenues are based on four quarters ending December 1986 and December 1987 ranking is EMC Corp., which checks in at 10th place. EMC, founded in 1979, produces memory expansion boards, main storage upgrades, disk subsystems, workstation controllers, and diagnostic software. Its products enhance DEC VAXs, IBM systems from the System/36 to 308X mainframes and 3880 cache controllers, and Hewlett-Packard, Prime Computer Inc., and Wang Laboratories Inc. minis. EMC's sales shot up 91 percent over 1986, to better than $127 million.

Courtesy Sun Microsystems

Sun chairman Scott McNealy

Higher-than-average R&D expenditures are 'much of what gives Sun the competitive edge.'

Terminal life

In 1987, terminal makers defied industry prognosticators, who had anticipated that microcomputers would flatten the terminal market. Apparently, some users are concluding that the high functionality of the micro isn't always an appropriate replacement for the terminal. Still, micro emulation boards accounted for 30 percent of the IBM 3270 terminal market, according to Leslie Lord, senior analyst for terminals at International Data Corp. The increase in sales of midrange processors also generated sales for the terminals that hang off them. Equally important, the terminal replacement cycle has shortened from approximately seven years to five years, and 1987 was the year that cycle hit, says Eileen O'Brien, IDC's senior analyst for ASCII and ANSI terminals.

In the ANSI terminal market, according to IDC, DEC maintained the top position, despite a 0.7 percent loss of market share. Wyse Technology, meanwhile, added to 2 percent to its ANSI terminal market share, and now controls 22.8 percent of that market. In the ASCII terminal market, Wyse held firm in the number-one slot, increasing its share by 4 percent, to 26.7 percent.

But it wasn't rosy times across the board for terminal vendors. Lee Data Corp. and Esprit Systems Inc. suffered 1987 losses of 4 percent and 2 percent, respectively. According to O'Brien, Esprit brought its new product to market too late to change its fortune, while Lee Data was stung by the fact that it offers systems-compatible terminals that require the purchase of controllers. Lee Data did deliver a plug-compatible last year, Lord notes, but not in time to reverse its 1987 financial plight.

Among vendors of scientific and engineering systems, Sun Microsystems Inc. rose from the number-six position to the top of the list, garnering a 121 percent growth in revenues above 1986. Laura Conigliaro, first vice president at Prudential-Bache Securities, credits Sun's emergence to the fact that it "has headed up the irrevocable drive within the computing industry toward distributed computing and open systems."

Blessed with such massive growth, Sun is now beset with controlling it—perhaps the one area that analysts look to with caution. According to Conigliaro, Sun can't possibly put the same kind of priority on its internal structure as it puts on technology and product growth. Nevertheless, she lauds Sun's care in adding new personnel. Austin Mayer, director of industrial relations at Sun, says the company adds about 250 employees per month to its payrolls. Thus far, growth hasn't come at the expense of productivity. In 1983, Sun's revenue per employee was $89,000; in 1987, it reached $126,000. According to Mayer, in the first nine months of fiscal 1988, Sun produced $141,000 in revenue per employee.

Last year, Sun spent about $70 million on R&D, with about half allocated to hardware. Financial analysts often criticize Sun for its heavy R&D spending; Sun spends about 14 percent of revenue on R&D, compared with typical expenditures of about 9 percent. Mayer counters that "R&D expenditures are much of what gives Sun the competitive edge."

With product life cycles that range from 12 months to 15 months, substantially lower than the industry's three- to five-year norm, Sun has no intention of curtailing R&D expenditures. Sun will boost R&D expenditures in 1988 to about $125 million, says Mayer. The largest portion will be dedicated to graphics development, but an increasing amount will be dedicated to Unix.

Apollo Computer Inc. knows what getting to the Unix gate—and not getting to it—can mean. By marketing a proprietary operating system until 1985, Apollo almost missed the race toward Unix and open systems. Reputations are neither made nor shaken easily in this business. According to Conigliaro, it has taken time for Apollo to be recognized in the Unix market, while Sun has been the standard-bearer. Sun, she says, has exploited the technology well.

That's a lesson that a number of vendors seem to have learned. **D**

Laura Daly, a free-lance editor based in Maywood, NJ, contributed to this performance report.

THE DECISIONS/PAINE WEBBER SURVEY

I/S ON TELECOMM: SHOW ME

Corporate information managers won't invest in new telecomm equipment and services without a clearer read on their value.

by Patrick Flanagan

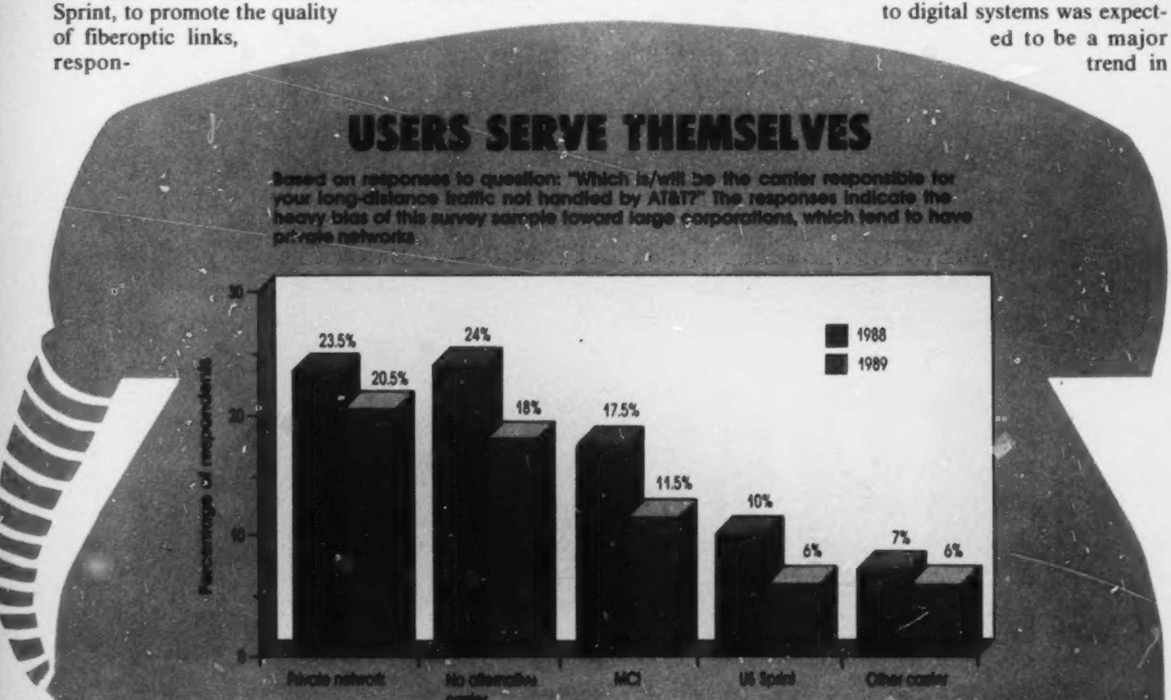
Results from the first five DECISIONS/Paine Webber Surveys of MIS Attitudes suggest that telecommunications vendors are having a hard time convincing information executives that the leading edge of telecomm technology is the place to be.

Clearly, information executives are taking a conservative approach to telecommunications, according to responses to the quarterly surveys conducted by DECISIONS and Paine Webber Inc., New York. Consider the following generalizations drawn from survey data:

- While the major communications carriers invest billions in digital facilities, respondents are only slowly switching from analog systems.
- Despite efforts by alternative carriers, particularly US Sprint, to promote the quality of fiberoptic links, respondents still put more stock in low prices than line quality.
- Respondents apparently don't value having a wide range of choices in telecommunications equipment; they're consolidating spending with AT&T, IBM/Rolm, and Northern Telecom Inc.

The five DECISIONS/Paine Webber surveys conducted to date cover the second quarter of 1987 through the second quarter of this year. Respondents to the survey view telecomm from a broad perspective; only about 40 percent have the direct responsibility for telecommunications associated with telecomm managers.

The conservative bent of the group covered by the surveys is most evident in data on the use of digital technology for voice and data transmissions. Conversion from analog to digital systems was expected to be a major trend in


USERS SERVE THEMSELVES

Based on responses to question: "Which is/will be the carrier responsible for your long-distance traffic not handled by AT&T?" The responses indicate the heavy bias of this survey sample toward large corporations, which tend to have private networks.

Figure 1

DECISIONS chart

the wake of the AT&T divestiture. Yet survey respondents indicate their corporate use of digital facilities has increased at a rate much slower than the rate at which carrier dollars are being poured into the technology.

Survey respondents indicating that more than 50 percent of their organization's voice traffic was digital in nature grew to 49 percent from 38 percent between February 1987 and February 1988, the period covered by the surveys. The pendulum is slowly swinging toward higher percentages of data transmission as compared with voice. The number of respondents reporting that voice comprised 90 percent or more of total communications volume in their organizations dropped by 5.5 percent during the period.

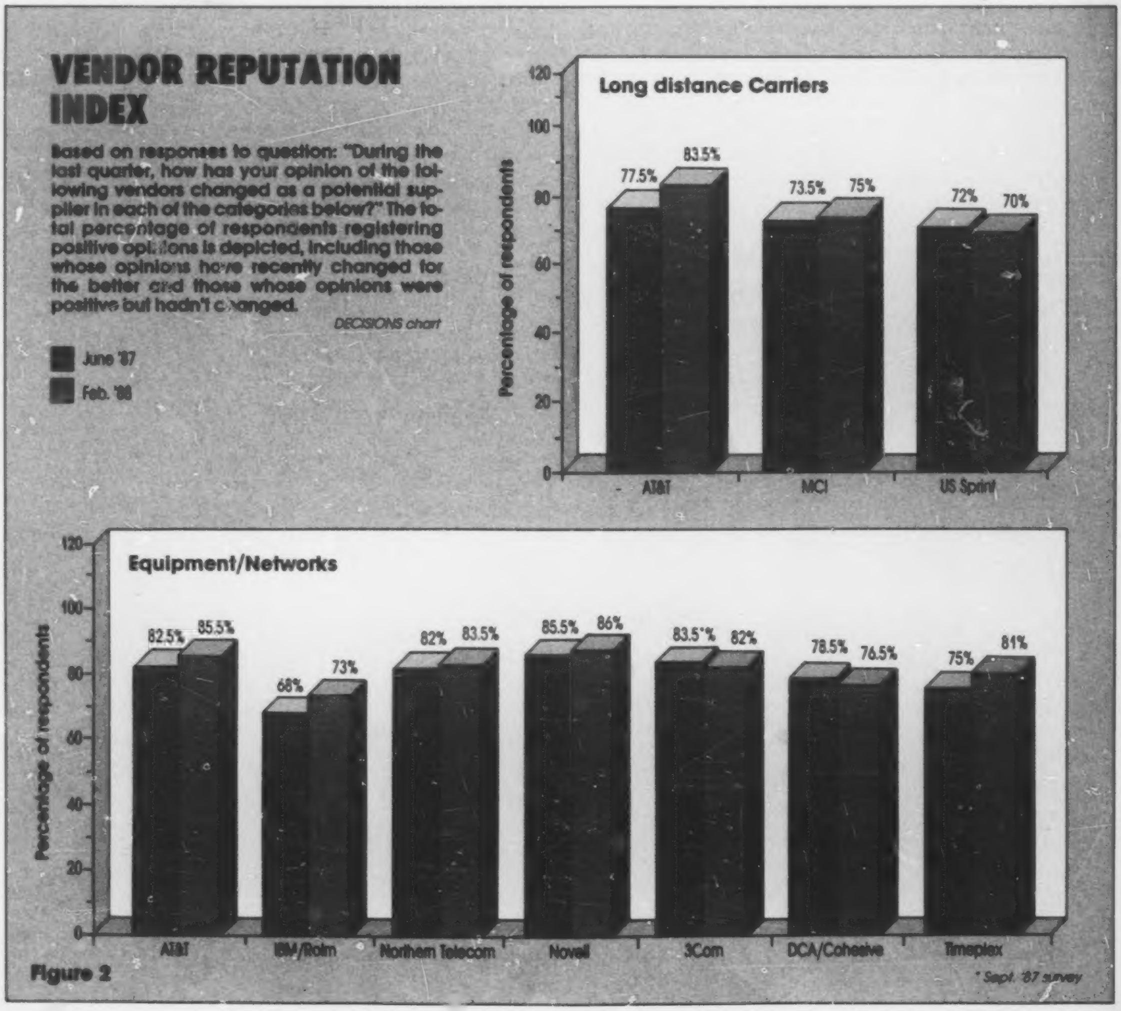
"The carriers are betting on any new applications going into digital as well as on converting existing [analog] demand," says Jack Grubman, telecommunications analyst at Paine Webber. "Demand for digital is growing as more applications require integration of voice and data."

In some quarters, anyway. Among survey respondents, there's a real split between heavy and light spenders on digital systems. Major corporations are leading the way with advanced applications, and they're implementing digital facilities to support them. Howard Frank, chairman of Network Management Inc., Fairfax, VA, notes that corporations with large private networks typically require enough capacity to make investments in digital facilities pay off.

Westinghouse Corp., the giant Pittsburgh-based conglomerate, is an example. "Since divestiture, no single vendor can provide the range of services we provide ourselves at the cost we're paying," says Tom O'Toole, manager of telecommunications systems. Westinghouse's in-house network includes a 10-node private network, T-1 multiplexer connections to 90 locations, and an internal phone system with direct dial-in access from the outside. "We've essentially got our own area code," says O'Toole.

But a large part of the market—medium-sized companies and even some large corporations—is moving much more slowly to digital communications. The large majority of data transmissions continue to be analog-based, and the volume of data communications is too small to justify replacing modems with direct digital connections.

Rob Marsicek, data processing manager for Mannesmann Tally, a printer manufacturer in Kent, WA, expresses a typical sentiment. Mannesmann Tally's single warehouse is served by one dialup modem. Most of the



VENDOR REPUTATION INDEX

Based on responses to question: "During the last quarter, how has your opinion of the following vendors changed as a potential supplier in each of the categories below?" The total percentage of respondents registering positive opinions is depicted, including those whose opinions have recently changed for the better and those whose opinions were positive but hadn't changed.

DECISIONS chart

Figure 2

* Sept. '87 survey

company's communications volume is voice and facsimile. Marsicek sees no real need to upgrade his private branch exchange or junk his modem. "Telecomm is a pretty flashy industry with lots of aggressive salesmen," he says. "What they haven't done is give us a valid reason to do anything differently than we're doing now."

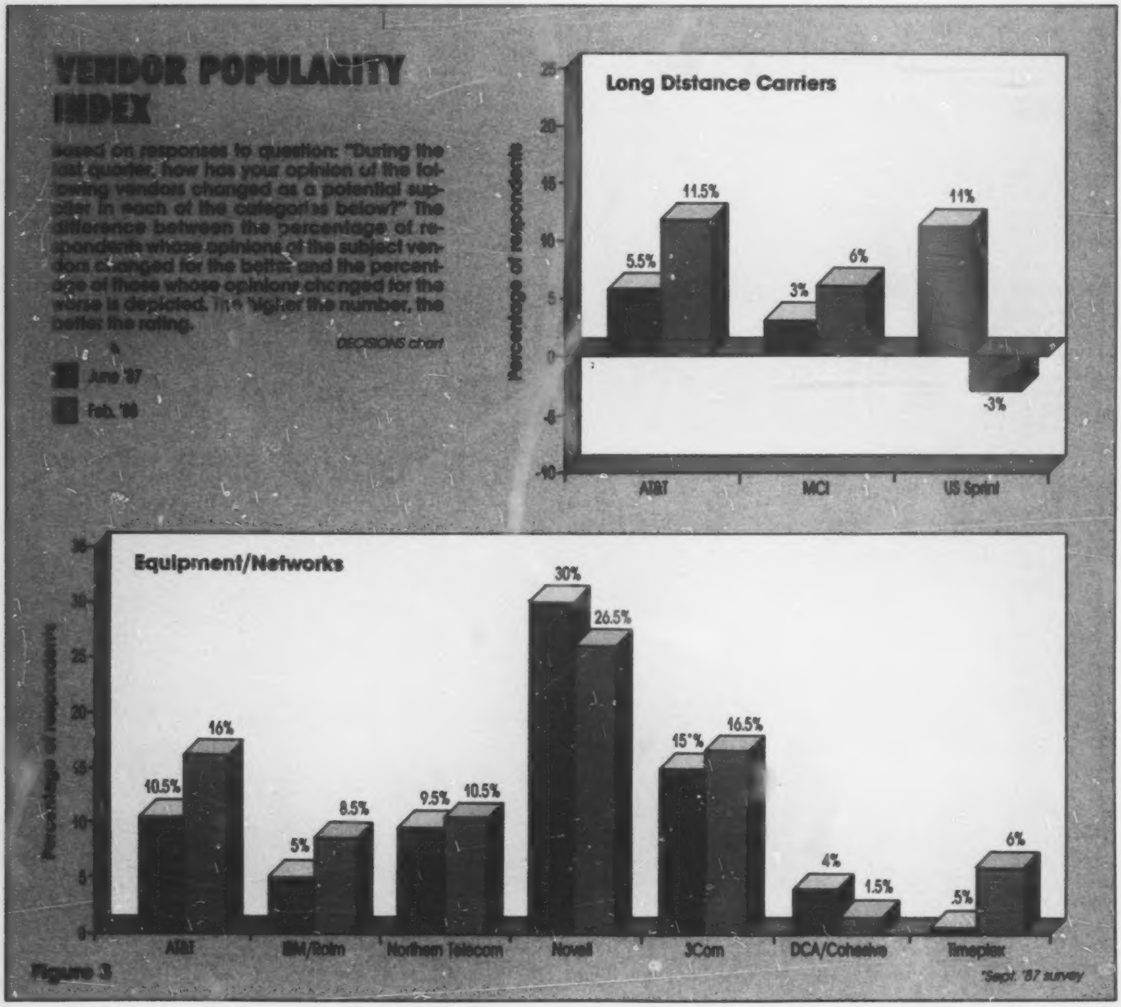
Frank believes the carriers have a big marketing hurdle to overcome. "Digital [communications] doesn't do that much for users compared with the last generation of analog systems," he says. The improved error rates of digital facilities, for example, aren't important for voice except in the rare case when transmission errors prevent a connection. Also, there's no cost advantage in moving to digital except in huge private networks, Frank says.

The importance of low prices to users was borne out by responses to other parts of the surveys. Last June, respondents to the DECISIONS/Paine Webber survey were asked for the primary reason that they would give more of their long-distance business to an alternative carrier. For 54 percent of the respondents, price was the reason. Only 23 percent indicated quality of connections as a reason, and just 4 percent cited the availability of fiberoptic lines.

At first look, these results support the argument that communications capacity has become a commodity sold on price alone. However, that's probably only part true. Responses to a second question on the June 1987 survey suggest price discounts don't move respondents unless they are deep. The question asked respondents what discounts from AT&T's rates are adequate from an alternative long-distance carrier, assuming technical equivalence. Over 40 percent cited discounts of 10 percent or more, and 39 percent wanted markdowns in the 6 percent to 10 percent range.

Results from the most recent survey suggest that MCI Corp., US Sprint, and the other common carriers will be competing for a static share of corporate telecomm budgets. Respondents to the latest survey report that MCI and US Sprint together will comprise 27.5 percent of the traffic carried by alternative carriers during the next year. They expect their in-house networks, on the other hand, to carry 23.5 percent of their non-AT&T traffic. And 24 percent say they don't expect to use an alternative carrier during the next year (see Figure 1).

With the exception of AT&T, vendors vary greatly in



VENDOR POPULARITY INDEX

Based on responses to question: "During the last quarter, how has your opinion of the following vendors changed as a potential supplier in each of the categories below?" The difference between the percentage of respondents whose opinions of the subject vendors changed for the better and the percentage of those whose opinions changed for the worse is depicted. The higher the number, the better the rating.

DECISIONS chart

■ June '87
■ Feb. '88

Figure 3

*Sept. '87 survey

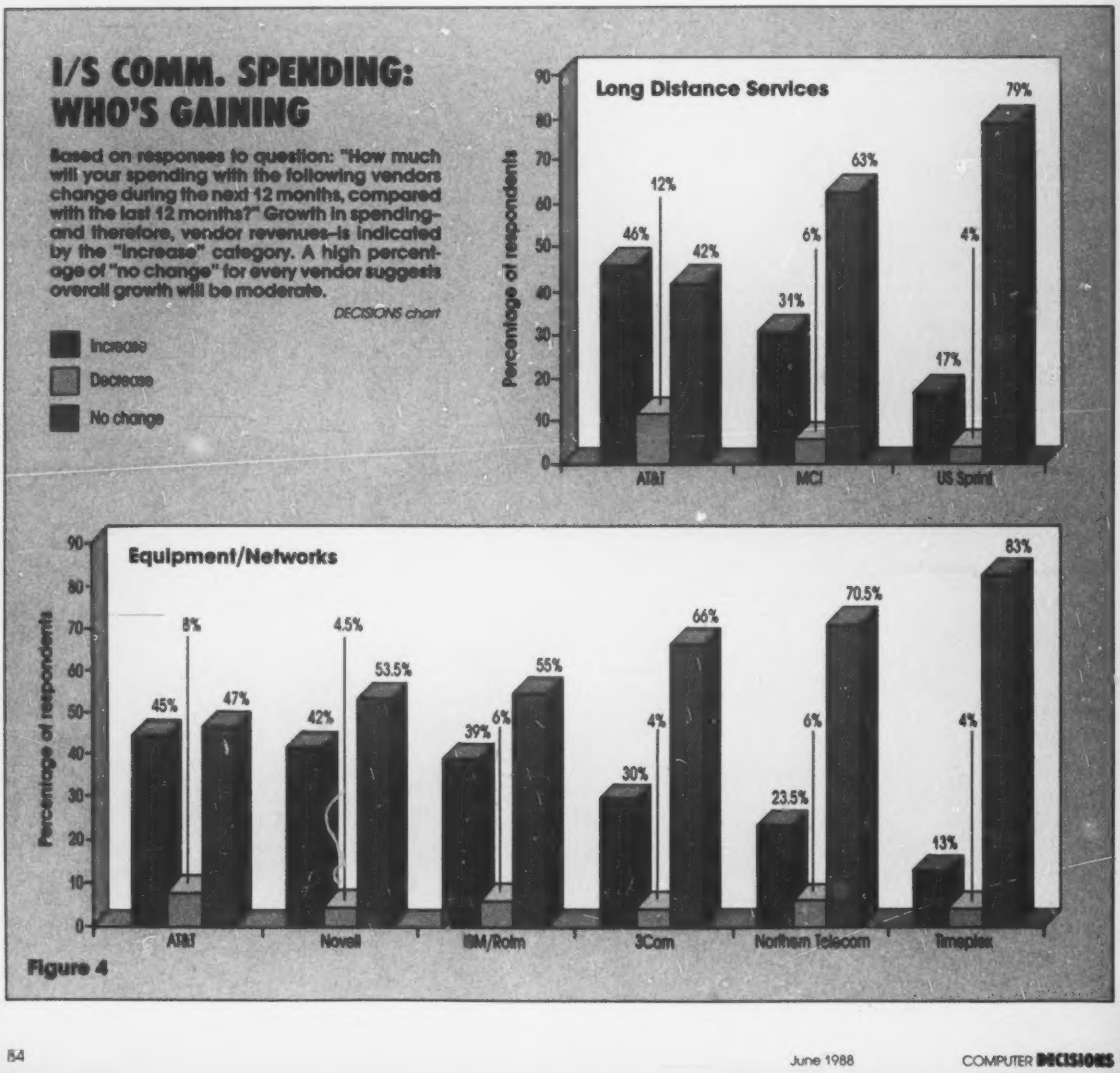
terms of how users view their popularity and reputation. The two primary competitors to AT&T in the switching area, IBM/Rolm and Northern Telecom (Nashville, TN), are enjoying high degrees of popularity and reputation. Novell Inc. (Orem, UT), which is riding the LAN trend, has come on the strongest in terms of popularity, and has also showed strength in reputation rating. Its prime competitor, 3Com Corp. (Santa Clara, CA), is also getting favorable reviews.

"There is a consolidation going on in the large-scale systems market sector," Grubman says. "My hunch is that AT&T, IBM/Rolm, and Novell will emerge as the leaders. Grubman is bearish on T-1 equipment suppliers. "T-1 multiplexers were the hot boxes a few years ago, but vendors are finding that smaller companies don't have the technological expertise to take full advantage of T-1 capabilities," he asserts. Grubman expects AT&T, MCI, US Sprint, and the regional carriers to offer more data capabilities on their public networks as an alternative to internal use of T-1 technology.

Results from the DECISIONS/Paine Webber surveys also permit the calculation of indexes that indicate a vendor's relative popularity and reputation among respondents. Popularity is measured by subtracting the difference between the percentage of respondents who said their opinion of a vendor changed for the worse during the quarter from the percentage who said their opinion changed for the better. Reputation is measured by adding the percentage of respondents who said their opinion of a vendor changed for the better to the percentage of those whose opinions were positive but unchanged.

AT&T over the past four quarters has both a solid popularity and reputation index as a carrier, showing particular strength in the first quarter of this year. MCI has also come on positively in terms of reputation. For US Sprint, a drop in popularity probably stems from that carrier's well-reported management, billing, and customer service problems that may or may not be on the way to resolution.

AT&T will certainly withstand the onslaught of MCI, US Sprint, and other carriers, says Grubman. "AT&T is tenacious as hell, particularly among corporate customers," he says. "It is going to get even more flexible in its pricing of services, and as a consequence is going to be a tougher and tougher competitor." **D**



I/S COMM. SPENDING: WHO'S GAINING

Based on responses to question: "How much will your spending with the following vendors change during the next 12 months, compared with the last 12 months?" Growth in spending—and therefore, vendor revenues—is indicated by the "increase" category. A high percentage of "no change" for every vendor suggests overall growth will be moderate.

DECISIONS chart

Figure 4

COMPUTER

DECISIONS

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CONGRESSIONAL INFO
4520 EAST WEST HWY
WASHINGTON DC 20014

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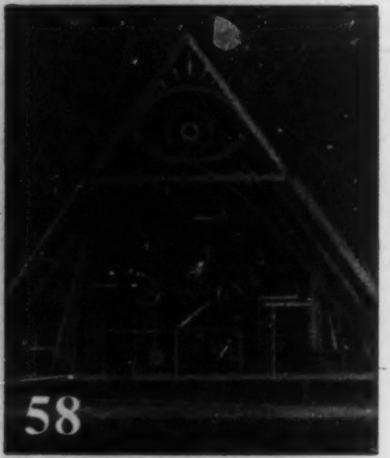
COMPUTER DECISIONS

Vol. 20 No. 9 September 1988



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EDITOR'S MESSAGE

Hospital, Heal Thyself

It's been a little while since the major insurance companies and the federal government—the latter via Medicare/Medicaid rate adjustments—delivered an ultimatum to the nation's health care complex. It is, in effect, the title of this piece.

How have the hospitals responded? Contributing Writer Patrick Flanagan's effort beginning on page 43 of this issue emphatically confirms that things are not going all that well. The treatment of more than half of all U.S. hospital patients currently represents a net loss to the institutions treating them. Further, about one out of every 10 hospitals currently in existence is expected to close its doors for financial reasons within five years.

Almost miraculously, there has not yet been an accompanying downturn of the same magnitude in the quality of medical care available to the average American. However, it's clear this won't go on forever without a massive transfusion of modern business methods. One auditing firm told Flanagan it finds a mistake on nine out of every 10 hospital bills over $5,000 it reviews. For information managers who want to make a mark, this represents a golden opportunity. Golden in the true sense, Flanagan reports, because hospital managers now realize they must bid for and win I/S talent from the most lucrative corporate environments.

Uncle Dougal knew years ago that the real risks of hospital procedure lay in the presentation of the bill. Once, as he went under to have his gall bladder excised, he told his doctors that as long as they were going to be in the neighborhood, they should have a look at his liver—a center of personal concern for good reason and the subject of his first query later when the anesthesia wore off.

"You have the liver of a 21-year-old," the surgeon said, sensing the need for ultimate reassurance.

Struggling painfully to his elbows, Uncle Dougal fixed him with a baleful glare. "You hopeless quack," he said, "I refuse to pay for any unauthorized transplants."

Robin Nelson

Cover Photograph:
Kim Steele
(Photo taken at the New York Eye & Ear Hospital. Special thanks to Stephen L. Bosniak, M.D.)

TECHNOLOGY TRENDS/Manufacturing

AS/400: PLANT CONTROL OPTION

Barbara Francett

The growing tendency at manufacturing companies to decentralize plants and operations has made the midrange machine a natural, at the expense of the mainframe. Digital Equipment Corp. has capitalized most on this trend. Now there's a new option that could shift the preference in plant control systems: IBM's Application System/400.

The six-model AS/400 line sports features that might lure more manufacturing business. These features include an enhanced relational database management system, as well as connectivity capabilities across the line—which is lacking in IBM's System/3X minicomputers.

For manufacturing control applications, IBM's System/3X line has competed most directly with DEC's VAX and MicroVAX machines and Hewlett-Packard Co.'s HP 3000 computers. DEC currently holds a 12 percent lead over IBM as the preferred midrange supplier, according to a recent survey of 154 manufacturing companies by the Sierra Group, Tempe, AZ-based market researchers (see chart). The Sierra Group determines preferred suppliers by the number of vendor mentions by respondents, rather than the number of systems installed. A year ago, IBM held an 8.5 percent lead over DEC, according to a study the group conducted in 1987.

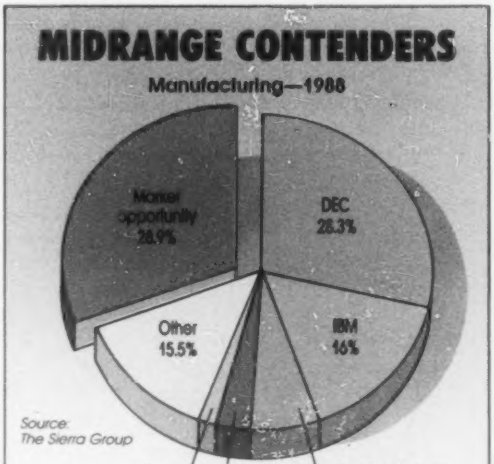
The Sierra Group's findings indicate that the midrange market at manufacturing concerns is far from saturated. Nearly 30 percent of manufacturing sites surveyed in this year's study have no midrange system at all, a vacuum all contenders are racing to fill. And with the AS/400, IBM can close a gap that its 937X line failed to fill, says Nancy Kirk, the Sierra Group's director of industry research. Kirk says the most immediate impact the AS/400 will have on the competitive race is to slow most midrange purchases while users assess IBM's new offerings.

Software vendors hoping to cash in on the AS/400's acceptance as a manufacturing machine give IBM's new line high marks. "The AS/400 offers a dramatic improvement in price/performance that will make it easier for manufacturers to cost justify the systems they need to stay competitive," says Roger Covey, president of System Software Associates Inc. (Chicago), maker of Business Planning and Control System software for manufacturing resource planning. Covey notes that IBM's high-end AS/400 models, the B50 and B60, provide a simple solution for System/36 and System/38 users that need more power and capacity. Those two models offer up to twice the power and capacity provided by the System/38.

While the high-end models will offer System/3X users an alternative to a mainframe investment, Covey contends, the low-end B10, B20, B30, and B40 models will appeal to new customers. He adds that manufacturing customers will use AS/400's greater connectivity and flexibility as a path to computer-integrated manufacturing. SSA's AS/400 version of its MRP software is available now at prices ranging from $4,000 to $6,000 per module for low-end AS/400 models and $20,000 to $30,000 per module for high-end models.

Another product that may gain from AS/400 acceptance is Prism, an MRP series from Marcam (Needham, MA). John Campbell, executive vice president, says the biggest advantage the AS/400 offers is a rich library of applications. "Manufacturers are looking for packaged solutions," he asserts. "With the AS/400, users can pick a standard and run it from very small to very large plants." Marcam sells its Prism/AS modules for $14,000 to $45,000.

John Stahler, data processing manager at Duracell Corp. in Lancaster, SC, currently uses System/38s as base machines, and he's running out of power on them. The AS/400's addition of Structured Query Language to the integrated relational DBMS will help him a lot, he says. But connectivity remains a question in Stahler's view. "Most manufacturers have a number of machines from different vendors," he notes. "How do you tie them together? That's still up in the air. We haven't seen all the AS/400 can do." ■



Source: The Sierra Group

IBM hopes its new AS/400 line will help it in its tussle with DEC for a larger share of the manufacturing market for midrange systems, a third of which is up for grabs.

PERFORMANCE REPORT: SOFTWARE & SERVICES

MEGABUCKS AND MEGADEALS

The byword for software and services vendors is growth—through acquisition, greater sales, and greater importance to corporate America.

by John Soat

Christopher Carleton has a simple formula for tracking the health of the software and services industry. The communications director for Adapso, the industry's trade association, says that in hard times, "membership dues are the first to go." Carleton knew early on that 1987 was going to be a good year. The obvious tip-off: "Companies kept up their memberships."

For the four quarters ending March 31, 1988, the combined revenues of the top 30 vendors of software and the top 30 of computer services reached $17.84 billion, a 22 percent increase over the comparable period a year earlier. For the 30 leading suppliers of software for midrange and large systems, revenues totaled $4.15 billion, for a growth rate of 31 percent over the prior year. The top five software firms grossed more than $1.6 billion. Their average growth rate of 44.4 percent was fueled by phenomenal customer demand for products from Oracle Corp., and big acquisitions made by Computer Associates International Inc.

Computer services companies reported respectable increases as well. Gross revenues for the top 30 providers weighed in at more than $13.68 billion, for a healthy 19 percent increase over 1987. Anacomp Inc. led the software and services pack in growth on the strength of a 279 percent increase, propelling the company from 23rd to 10th on the DECISIONS list of services vendors. And on the heels of several acquisitions, Atlanta-based First Financial Management Corp. grew 179 percent to $233.6 million, upping its rank from 26th to 14th on the services list.

Oracle's impressive climb from number 12 to number 4 on the software list signifies a ringing endorsement for relational database technology. "Applications are aging," says Peter Tierney, marketing vice president at Oracle, "and there is a demand for new technology."

Unix is just such a technology. Aided by a 200 percent increase in Unix sales, Relational Technology Inc. rose to 16th place on the software lineup, from 22nd place last year. Informix Software Inc., another Unix vendor, saw revenues in the first calendar quarter of 1988 jump to $25 million, a 98 percent increase over first quarter 1987 sales. "Unix is mushrooming," says Stephen Hill, director of product marketing.

Ted Hardin

Computer Associates CEO Charles Wang

While there are additional information technology companies with software and services revenues large enough to qualify for top rankings (IBM is an obvious one), companies are categorized for purposes of the four DECISIONS market surveys (micros, large systems and peripherals, software and services, and communications) by the market segment from which they garner their greatest information systems and services revenues. Their rank within that category is then based on their total information systems and services revenues.

One significant trend reflected in the financial results posted by software and services vendors is that merger and acquisition activity continues its unabated pace. Another is that the much-predicted takeoff in professional computer services is well underway. A third is that the two segments of the industry are moving closer together.

The heady pace of mergers and acquisitions brought instant growth to many companies. Often the motivation is for a ready-made product line. For instance, when Informix merged with Innovative Software Inc. this past February, it was primarily because Informix wanted a tried and true line of office automation soft-

> ***'More acquisitions doesn't necessarily mean fewer companies in the market.'***

ware. In discussing the merger, Informix's Hill strikes a note appropriate to the merger and acquisition spirit of the whole industry: "We could have developed [the software] ourselves," he says, "but it would have taken too long."

Richard Derk/Picture Group

George Shaheen of Arthur Andersen

'MIS has not been viewed as a great success by [corporate] management.'

A lot of companies seem to have been in a hurry. According to Broadview Associates, a Fort Lee, NJ, investment banker for the information technology industry, the total number of merger and acquisition transactions in the software and services industry in 1987 was 358, up 17 percent from 1986. The value of those deals was a whopping $4.9 billion. Although 70 percent of the 1987 transactions involved small to medium-sized companies, with a median transaction size of $4 million, the list of megadeals is indeed long. Topping that list: the $830 million purchase of Uccel Corp. by Computer Associates.

Recent events indicate that Computer Associates' acquisition appetite has yet to be satiated. In June, Computer Associates went after Management Science America Inc., the third-largest company in the DECISIONS software survey. But the MSA board of directors rejected the proposal, and Computer Associates withdrew its offer.

The merger and acquisition fervor intensified in the first half of this year: The value of software and services transactions in that six-month period surpassed the total value for all of 1987. According to the midyear Adapso/Broadview Associates index, the 190 deals cut in the first six months of 1988 had a total value of $5.4 billion.

All these mergers and acquisitions don't necessarily portend a much-anticipated industry consolidation, however. Charles Wang, chief executive officer of Computer Associates, points out that for every software company that is acquired, several more are started. "More acquisitions doesn't necessarily mean fewer companies in the market," he says. Richard Dorfman of Broadview Associates sees "a lot of concentration, not consolidation," claiming there's equilibrium between mergers and startups.

Still, Computer Associates' most recent stab at another megadeal indicates the temperament of the post-crash market. "The October crash certainly didn't diminish enthusiasm for mergers and acquisitions," says Dorfman. In fact, it may have encouraged them. Dorfman claims that small companies began reconsidering public offerings after the crash, and larger firms took advantage of the unsure market to snap up weak firms.

The weak U.S. dollar made for strong sales to Europe. Mario Morino, chairman of Morino Associates Inc., cites a 79 percent increase in overseas revenues in the last year. Oracle's European revenues grew to a 50 percent share, while Relational Technology saw European sales capture 40 percent of its total revenues.

The weak dollar also led to the acquisition by foreign companies of American concerns, a trend that Broadview's Dorfman refers to as the "globalization" of the software and services market. That the software market has been dominated by American companies hasn't been lost on foreign competitors. Although Adapso's Carleton claims that software is "still an American industry," continued globalization could tip the scales.

Would-be acquirers also showed a rising interest in services firms. According to the Adapso/Broadview index, professional services companies accounted for 21 percent of the deals in the first half of 1988, up from 12 percent in the first half of last year. And new players are suddenly awakening to the growth and profitability of the computer services sector. Just this June, Nynex Corp. (New York), a regional Bell holding company, moved into the market with a definitive agreement to acquire the professional services and software products businesses of AGS Computers Inc.

The Big Eight accounting firms continue to gain ground in the services race. Riding a 32 percent growth that boosted services revenues to more than $838 million, Arthur Andersen & Co. became the fifth-largest services vendor. From the number 22 post in last year's survey, Arthur Young & Co. climbed to number 16 on a 57 percent growth in revenues.

For services vendors, competition in the commercial arena may become even hotter in the wake of the procurement scandal that has rocked the U.S. Department of Defense. As the contract approval process in the government slows down, the government's traditional services suppliers, such as TRW Inc., may turn more attention to commercial work.

Why the heightened interest in computer services? "More decentralization of business," answers Patrick Gross, chairman of American Management Systems Inc., "which makes for a greater mix of internal staff and outside services." John P. Imlay Jr., chairman of MSA, sees it as a focusing of demand. "Corporations are no

'88	'87	Large-System Software	'88 I/S Revenues (000)	'87 I/S Revenues (000)	Percent Growth	Total '88 Revenues (000)	Total '88 Profits (000)	FY End
1	1	Computer Associates Int'l. Inc. *(Garden City, NY)*	709,109	452,289	57	709,109	101,828	Mar.
2	2	Dun & Bradstreet Corp. *(New York)*	*270,000	*270,000	NA	3,359,164	392,999	Dec.
3	3	Management Science America Inc. *(Atlanta)*	245,547	210,541	17	245,547	(5,509)	Dec.
4	12	Oracle Corp. *(Belmont, CA)*	228,317	101,709	124	228,317	31,420	May
5	5	Cullinet Software Inc. *(Westwood, MA)*	216,653	174,891	24	216,653	(47,021)	Apr.
6	4	Sterling Software Inc. *(Dallas)*	201,161	196,673	2	201,161	6,794	Sep.
7	7	AGS Computers Inc. *(Mountainside, NJ)*	197,941	153,128	29	533,286	16,433	Dec.
8	6	Policy Management Systems Corp. *(Columbia, SC)*	188,550	160,025	18	188,550	17,947	Dec.
9	9	Applied Data Research Inc. *(Princeton, NJ)*	*172,900	*132,400	31	172,900	NA	Dec.
10	13	Pansophic Systems Inc. *(Oak Brook, IL)*	149,583	102,222	46	149,583	14,573	Apr.
11	11	SAS Institute Inc. *(Cary, NC)*	*135,300	*102,400	32	135,300	NA	Dec.
12	14	Cincom Systems Inc. *(Cincinnati)*	*132,500	*100,000	33	132,500	NA	Sep.
13	16	Ask Computer Systems Inc. *(Los Altos, CA)*	127,362	93,489	36	127,362	9,333	Jun.
14	10	Triad Systems Corp. *(Sunnyvale, CA)*	122,472	111,981	9	122,472	6,911	Sep.
15	15	Information Builders Inc. *(New York)*	*113,500	*95,000	19	113,500	NA	Dec.
16	22	Relational Technology Inc. *(Alameda, CA)*	*87,400	*46,600	88	87,400	7,500	Jun.
17	18	Compuware Corp. *(Birmingham, MI)*	86,000	62,200	38	86,000	NA	Mar.
18	20	On-Line Software Int'l Inc. *(Fort Lee, NJ)*	84,517	53,434	58	84,517	6,354	May
19	—	Informix Software Inc. *(Menlo Park, CA)*	(R)81,278	(R)41,430	96	81,278	(R)9,201	Dec.
20	17	Comshare Inc. *(Ann Arbor, MI)*	77,085	68,493	13	77,085	1,904	Jun.
21	19	Software AG Systems Inc. *(Reston, VA)*	73,354	66,485	10	73,354	4,553	May
22	—	Cognos Inc. *(Ottawa, Ontario)*	70,369	57,997	21	70,369	2,656	Feb.
23	—	Interleaf Inc. *(Cambridge, MA)*	58,389	37,173	57	58,389	6,980	Mar.
24	23	American Software Inc. *(Atlanta)*	*54,187	*46,727	16	54,187	10,335	Apr.
25	26	Boole & Babbage *(Sunnyvale, CA)*	48,810	37,293	31	48,810	6,355	Sep.
26	21	Intermetrics Inc. *(Cambridge, MA)*	47,363	47,747	-1	47,363	2,173	Feb.
27	24	Hogan Systems Inc. *(Dallas)*	46,705	44,091	6	46,705	2,119	Mar.
28	27	Duquesne Systems Inc. *(Pittsburgh)*	43,686	33,207	32	43,686	9,405	Sep.
29	28	Morino Associates Inc. *(Vienna, VA)*	41,880	31,198	34	41,880	7,883	Jun.
30	29	Goal Systems Int'l. Inc. *(Columbus, OH)*	*40,000	*29,231	37	40,000	NA	Jan.
		Total Large-System Software	**4,151,918**	**3,160,054**	**31**			

'88	'87	Computer Services	'88 I/S Revenues (000)	'87 I/S Revenues (000)	Percent Growth	Total '88 Revenues (000)	Total '88 Profits (000)	FY End
1	1	TRW Inc. *(Cleveland)*	(E)1,960,000	(E)1,625,000	21	6,933,000	259,000	Dec.
2	4	Electronic Data Systems Corp. *(Dallas)*	1,524,200	1,176,700	30	4,518,500	347,600	Dec.
3	2	Automatic Data Processing Inc. *(Roseland, NJ)*	1,511,226	1,347,533	12	1,511,226	161,750	Jun.
4	3	McDonnell Douglas Corp. *(St. Louis)*	1,257,100	1,198,500	5	13,550,500	321,200	Dec.
5	7	Arthur Andersen & Co. *(Chicago)*	*838,400	*635,900	32	2,315,800	NA	Aug.
6	5	Computer Sciences Corp. *(El Segundo, CA)*	810,600	729,200	11	1,152,351	71,351	Mar.
7	6	General Electric Co. *(Fairfield, CT)*	*775,000	*775,000	0	40,515,000	2,915,000	Dec.
8	8	Martin Marietta Corp. *(Bethesda, MD)*	*506,000	*467,400	8	5,165,124	230,650	Dec.
9	9	Emhart Corp. *(Farmington, CT)*	*438,000	*408,896	7	2,454,500	106,500	Dec.
10	23	Anacomp Inc. *(Indianapolis)*	419,577	110,740	279	419,577	41,965	Sep.
11	10	Shared Medical Systems Corp. *(Malvern, PA)*	389,504	384,229	1	389,504	43,002	Dec.
12	12	Boeing Co. *(Seattle)*	*266,300	*300,000	-11	15,355,000	480,000	Dec.
13	11	Sorbus *(Frazer, PA)*	*255,000	*238,000	7	255,000	NA	Dec.
14	26	First Financial Management Corp. *(Atlanta)*	233,659	83,733	179	233,659	15,042	Dec.
15	13	Mtech Corp. *(Dallas)*	*232,100	*198,600	17	232,100	15,400	Dec.
16	22	Arthur Young & Co. *(New York)*	*204,000	(E)*130,000	57	738,000	NA	Oct.
17	17	American Management Systs. Inc. *(Arlington, VA)*	186,286	143,947	29	186,286	7,460	Dec.
18	15	Computer Task Group Inc. *(Buffalo, NY)*	181,114	149,983	21	181,114	5,323	Dec.
19	14	HBO & Co. *(Atlanta)*	178,559	151,030	18	178,559	13,519	Dec.
20	20	Touche Ross & Partners *(Toronto)*	*175,000	*135,000	30	1,750,000	NA	Aug.
21	21	Peat Marwick *(Montvale, NJ)*	175,000	125,000	40	1,600,000	NA	Jun.
22	—	SHL Systemhouse Inc. *(Ottawa, Ontario)*	173,340	116,601	49	173,340	22,262	Aug.
23	19	Systematics Inc. *(Little Rock, AR)*	168,677	135,114	25	168,677	13,674	May
24	24	Price Waterhouse & Co. *(New York)*	*152,000	*100,000	52	845,000	NA	Jun.
25	18	Grumman Corp. *(Bethpage, NY)*	149,395	137,767	8	3,431,080	(1,175)	Dec.
26	16	Intelogic Trace Inc. *(San Antonio, TX)*	130,329	145,250	-10	130,329	2,400	Jul.
27	—	Information Resources Inc. *(Chicago)*	106,471	98,345	8	106,471	(5,708)	Dec.
28	25	C3 Inc. *(Herndon, VA)*	101,966	86,300	18	101,966	13,346	Mar.
29	—	Sungard Data Systems Inc. *(Wayne, PA)*	97,653	75,018	30	97,653	8,915	Dec.
30	—	Fiserv Inc. *(Milwaukee)*	88,910	77,160	15	88,910	7,610	Dec.
		Total Computer Services	**13,685,366**	**11,485,946**	**19**			
		Total Software and Services	**17,837,284**	**14,646,000**	**22**			

** Fiscal year; (R) Restated figures; (E) Estimated figures*
Annual revenues are based on the four quarters ending March 1987 and March 1988. Cognos, Touche Ross, and SHL Systemhouse revenues are in U.S. dollars.

FAST TRACKERS

Company	'88 I/S Revenues (000)	'87 I/S Revenues (000)	Percent Growth
Anacomp Inc.	419,577	110,740	**279**
First Financial Management Corp.	233,659	83,733	**179**
Oracle Corp.	228,317	101,709	**124**
Informix Software Inc.	(R)81,278	(R)41,430	**96**
Relational Technology Inc.	*87,400	*46,600	**88**
On-Line Software Int'l. Inc	84,517	53,434	**58**
Computer Associates Int'l. Inc.	709,109	452,289	**57**
Arthur Young & Co.	*204,000	(E)*130,000	**57**
Interleaf Inc.	58,389	37,173	**57**
Price Waterhouse & Co.	*152,000	*100,000	**52**

*(R) Restated; (E) Estimated; * Fiscal year*

DECISIONS chart

longer just buying boxes and programming them," he says.

It might also reflect a general dissatisfaction with the performance of corporate Information Services, contends George Shaheen, managing partner for the U.S. Consulting Organizations within Arthur Andersen. "MIS has not been viewed as a great success by [corporate] management," Shaheen offers. Mike Cohn, principal consultant with Input, a Mountain View, CA-based market research firm, concurs. "Too often, MIS has been a day late and a dollar short in getting systems done," he says, citing the common corporate complaint of application backlogs. This has resulted, he concludes, in an "outsourcing of processing" to accommodate mission-critical systems.

The lines of distinction between software and services vendors are blurring.

But many information managers see the use of outside services as a practical, rational approach to the overall downsizing of American businesses. "The demand is for a complete solution," explains Darwin John, vice president of information systems for Scott Paper Co. (Philadelphia) and a member of the DECISIONS Editorial Advisory Board. "I/S has been downsized, yet demand [for I/S services] ~~has~~ not diminished," he says. For that reason, management must "go out to third parties to resource the work." John feels this is good for business because, he says, it allows firms to keep fixed costs down.

Shaheen asserts that his consultants are not meant to usurp the corporate information management function. "We do not compete with MIS internally," he says. "We augment." And AMS's Gross notes that the consultant has to target certain areas. "The more focused your expertise," he says, "the more value you provide."

As software vendors begin eyeing support as a key element in attaining new business as well as keeping old customers, they too are moving more into the realm of services suppliers. Professional services revenues at Hogan Systems Inc. now hover at 50 percent of total revenues; only a few years back, the company's sole revenue producer was its line of banking software. And Boston-based Keane Inc., which ranked 25th on last year's lineup of software companies, now derives 80 percent of its revenues from professional services. While Keane's 1988 revenues grew 16 percent, to better than $47 million, that total wasn't enough to earn it a spot on the top 30 list of services companies.

Input's Cohn points out that 35 percent to 40 percent of software revenues come from maintenance revenues. And most vendors are quick to agree with the statement by Computer Associates' Charles Wang that "support is the most crucial piece of the puzzle." Criticism that Computer Associates has sacrificed support for fast and furious growth is a sore spot for Wang, who says his company aims to improve by observing its competitors. "IBM hand-holds users better than almost anyone," he says. "We're learning that."

Increased emphasis on support helps blur the lines of distinction between software and services vendors. Input's Cohn notes that Oracle, for example, offers a consulting service that now represents 15 percent of the company's revenues. And American Management Systems, the 17th-largest services vendor, currently derives a quarter of its revenues from sales and licenses of software. According to AMS's Gross, the company plans on expanding its software line. Arthur Andersen views its Foundation computer-aided software engineering product line as "a key ingredient" in the company's services ventures, says Shaheen. "It is imperative that Arthur Andersen invest heavily in new technology," he adds.

John Imlay sees no great differentiation between the two sides of the industry. "We are a service business," says Imlay about software vendors in general and MSA in particular. "We're simply a subcontractor to the systems integrators."

If Charles Wang is right, the software and services industry is still an undersaturated marketplace. As evidence, he notes that each existing Computer Associates customer has on average only four of the 70 products in the company's line. That's but one focal point for the company's future growth.

George Shaheen's prognosis is even more bullish: "I don't think we've seen anything yet." **D**

Laura Daly, a free-lance editor from Maywood, NJ, contributed to this report.

THE DECISIONS/PAINE WEBBER SURVEY

UNIX:
JANGLED, MAYBE JINXED

Results of our latest survey indicate that OSF has tripped up Unix—just as Unix had begun gaining momentum. That gives IBM's SAA an opening.

by John Rymer

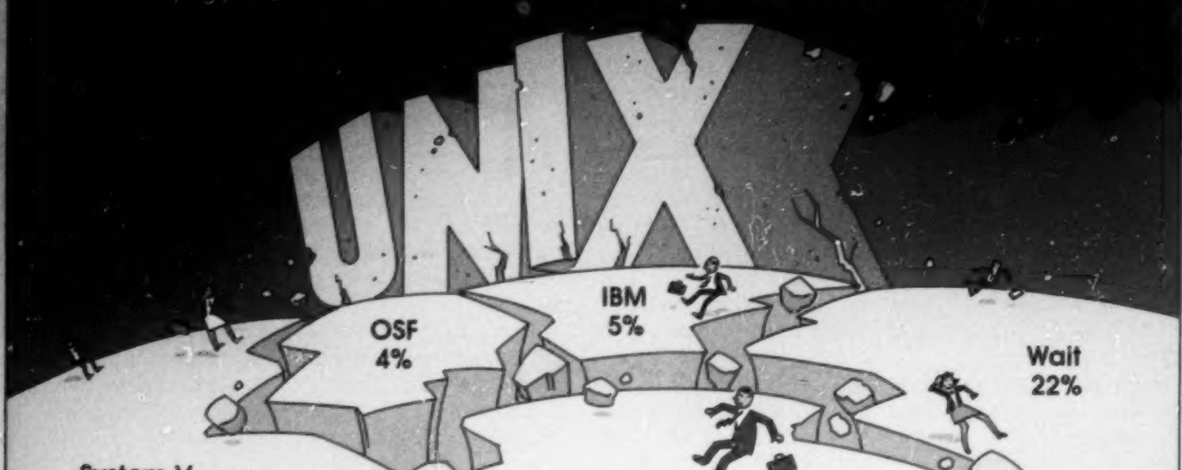
While IBM, DEC, Hewlett-Packard Co., and four other computer giants celebrated their establishment of the Open Software Foundation as a new beginning for the Unix operating system, corporate users were apparently spooked by the event. Among the 1,170 respondents to the latest quarterly DECISIONS/Paine Webber Survey of MIS Attitudes, 21 percent said they'd delay purchases of Unix-based systems in the wake of OSF.

That's bad news for AT&T and Sun Microsystems Inc., heretofore the leading champions of a broad-based Unix standard. Respondents who said they'd postpone Unix purchases outnumbered those who said they'd stick by AT&T's Unix System V. Support for IBM's Unix variant—AIX—and OSF's nebulous offering based on AIX adds to AT&T's woes (see chart below).

Apparently, the timing of OSF's founding couldn't have been worse for Unix. While respondents to the DECISIONS/Paine Webber surveys are not Unix devotees (46.5 percent cite no interest at all), they had been expressing increasing interest during the last nine months. Unix's importance to information systems planning leaped in the March 1988

WAIT UNTIL THE DUST SETTLES

Based on responses to: "A new Unix standard based on IBM's AIX (backed by the Open Software Foundation) has emerged to compete with AT&T's Unix. How will this development affect your Unix buying plans?"



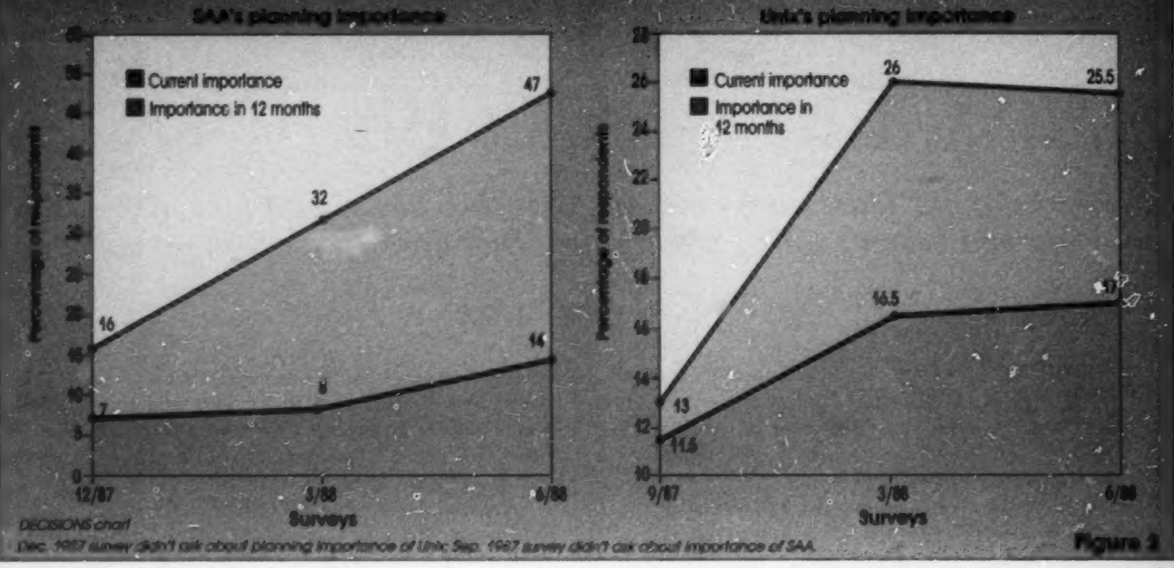
DECISIONS chart

Phil Scheuer

Figure 1

BATTLE OF THE SOFTWARE ARCHITECTURES

Based on responses to: "Please check those of the following that were/will be important to your information systems planning." Importance to planning during the next 12 months and current importance are depicted.



DECISIONS chart

Dec. 1987 survey didn't ask about planning importance of Unix; Sep. 1987 survey didn't ask about importance of SAA.

Figure 3

survey, from six months earlier. That interest, while respectable compared with other factors included on the surveys, has flattened for now.

By contrast, IBM's Systems Application Architecture has become a burning concern to respondents. IBM's goal with SAA is to achieve a homogeneous software environment on its three main processor platforms—the Personal System/2, the Application System/400, and the Enterprise System/3090. Homogeneity is also the goal vendors of Unix promote, albeit on computers from a variety of vendors.

SAA, which was announced on St. Patrick's Day in 1987, has finally come into its own, judging from survey responses. SAA and Operating System/2, which in IBM's software spectrum is part of SAA, were named by respondents as the most important factors in their systems planning. Is Unix's apparent dive among respondents a temporary phenomenon? That remains to be seen. Since the survey was taken, AT&T has backed off its initial denials of any interest in OSF. At press time, AT&T officials were hinting that the communications giant might actually join OSF after all, eliminating any split—real or perceived—in the Unix world.

The survey question regarding systems planning factors included a variety of technologies. In order of finish, they are expert systems, electronic data interchange, MS-DOS, optical storage, IBM's Enterprise Systems Architecture, Unix, image processing, and IBM's Advanced Program-to-Program Communications and Micro Channel Architecture.

Interest in OS/2 among survey respondents has been high since we first asked about the operating system in September 1987. When this interest is translated into spending, IBM stands to benefit, as does Microsoft Corp. (Redmond, WA), which codeveloped the operating system. In the latest survey's Vendor Popularity Index, which tracks short-term swings in user opinion, Microsoft registered +31 percent—the highest among software vendors (see chart on next page). In contrast, the popularity rating of Lotus Development Corp. (Cambridge, MA) continued to slide, to −3.5 percent from +3 percent in the previous survey. That means more respondents' opinions of Lotus changed for the worse during the last quarter than changed for the better. The decline may be linked to the slipping release deadline for Version 3 of Lotus 1-2-3. Still, Lotus, like Microsoft, continues to get strong ratings in the survey's Vendor Reputation Index. That index measures long-term satisfaction or dissatisfaction with a vendor.

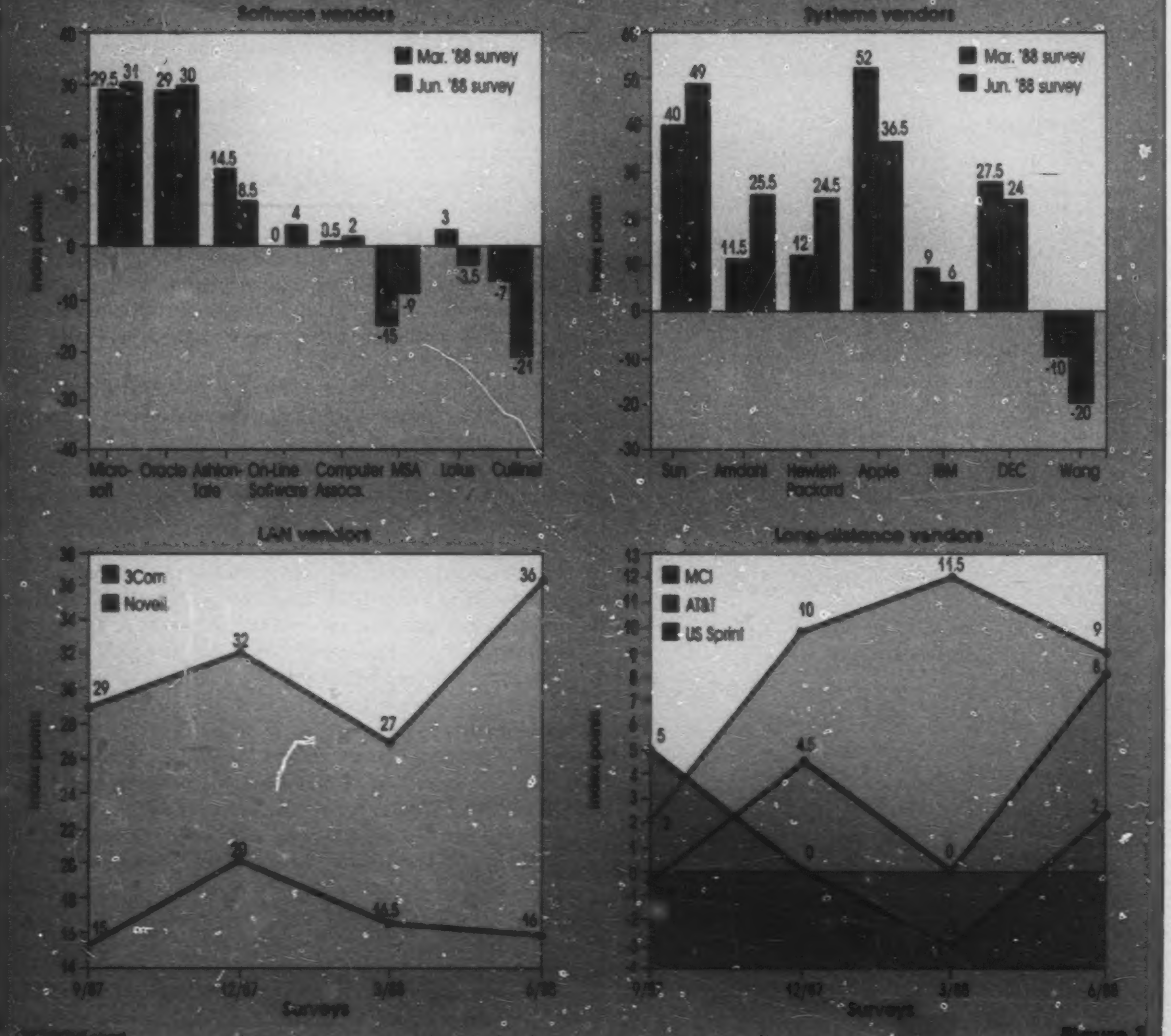
The big gainers in the latest popularity and reputation indexes are Amdahl Corp. (Sunnyvale, CA) and Hewlett-Packard. Both vendors' respective ratings doubled compared with the previous survey. Amdahl's spurt in popularity among survey respondents can be attributed to the aggressive moves that it has been making in the mainframe market. Shortly before the latest survey was mailed, in June, Amdahl announced the industry's first mainframe to operate at 100 million instructions per second. Deliveries of that machine are slated to begin early next year. Since then, IBM has announced the S Series of ES/3090 mainframes, which includes a model that IBM promises will operate at 130 MIPS. Still, Amdahl was able to reach the 100-MIPS plateau first.

Hewlett-Packard's rising popularity can be interpreted as a long-awaited vote of confidence in Spectrum, its ambitious program to remake its computer line using reduced instruction set computing technology. The arrival of what's officially called HP Precision Architecture was years in the making, and respondents to earlier surveys had indicated lukewarm interest in the RISC machines at best. Now, following second-quarter deliveries of a full line of Precision Architecture computers, it appears Hewlett-Packard is getting credit for its efforts.

The biggest decline in the popularity index was registered by Apple Computer Inc. (Cupertino, CA). Apple's latest rating, although a healthy +36.5 percent, was a sharp drop from the all-time survey high (+52 percent) that the micro maker registered in the previous survey. Apple's decline in popularity ratings may signal disapproval among survey respondents of the company's lawsuit against Microsoft and Hewlett-Packard for alleged copyright infringement.

IBM's roller coaster ride continued in the popularity index, dipping to +6 percent after rising to +9 percent in the previous survey from +1.5 percent in the December 1987 survey. If the past is prologue, IBM's June 21 announcement of the Application System/400 midrange line and July 27 unveiling of the ES/3090 S Series will send its popularity rating upward in the next survey. IBM's popularity index rating rose following its announcement of the Personal System/2 (in April 1987) and again after announcement of Enterprise Systems Architecture, an important extension of its mainframe architecture (in February 1988).

For DEC, however, the announcement of new offerings hasn't boosted its popularity ratings. Despite an important freshening last spring of its VAX processor lines (with the VAX 3600, 6200, and 8100) and the addition of important multiprocessor enhancements to the VMS operating system, DEC's popularity index rating in the latest survey continued a long fall from the high of +43 percent that DEC recorded in the initial DECISIONS/Paine Webber survey, taken in March 1987. DEC's rating now stands at +24 percent, which is below the ratings of both Amdahl and Hewlett-Packard. Whether the downward trend will be reversed by DEC's announcement on July 19 of its forth-



VENDOR POPULARITY INDEX

Based on responses to: "During the last quarter, how has your opinion of the following vendors changed as a potential supplier?" This index represents the difference between the percentage of respondents whose opinions changed for the better and the percentage of respondents whose opinions changed for the worse.

Figure 3

WORKSTATION BUYING PLANS

Based on responses to separate questions about workstation buying plans, PS/2 buying plans, and the importance of planning factors.

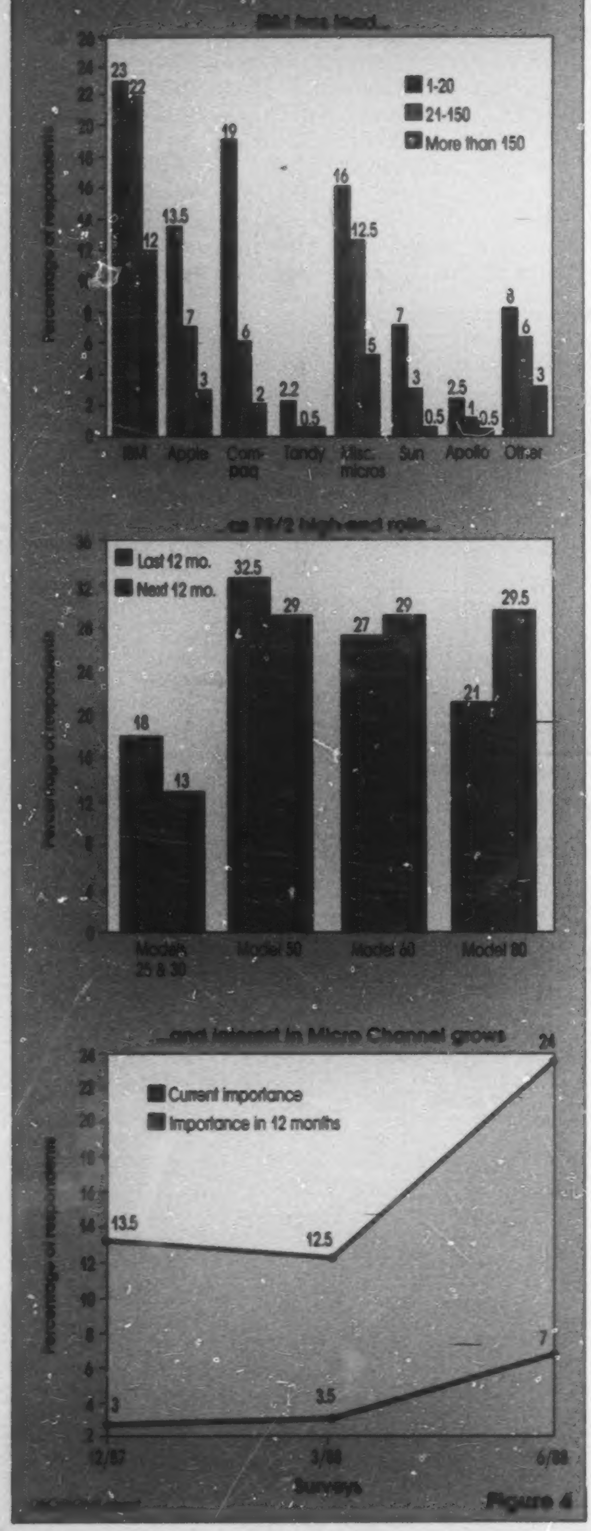


Figure 4

coming DECtp transaction processing offerings remains to be seen.

Although IBM is clearly the vendor of choice for both small- and large-quantity sales of microcomputers among respondents (see chart at left), the latest survey results suggest a flat micro market for IBM in the coming year. Respondents' plans for micro purchasing during the next 12 months don't indicate meaningful increases in market share for IBM. Survey results say the status quo will prevail for the foreseeable future.

Nonetheless, micro purchasing results do hold some good news for IBM: Over the next 12 months, respondents plan to buy more high-end PS/2 models, where IBM's margins are sweeter. At the same time, respondents anticipate reducing purchases of the lower-end PS/2 Models 25, 30, and 50. The biggest gainer in respondents' plans is the Intel 80386-based PS/2 Model 80. Almost 30 percent of respondents said they expect to buy Model 80s during the next 12 months, compared with 21 percent who bought them in the previous year. Most respondents buying the high-end PS/2s plan to buy small quantities, up to 20 units. Few—only 3 percent of respondents for the Model 60 and 2 percent for the Model 80—plan to buy quantities of more than 150. The growth for IBM among respondents will be in purchases of from 21 to 150 units.

Price is apparently an important consideration in corporate purchases of micros. "Miscellaneous PC," a category that includes IBM clones, is the leading source for volume buys, outpacing Compaq Computer Corp. (Houston), the performance leader.

The respectable showing of Sun Microsystems (Mountain View, CA) in micro purchase plans bodes well for Unix sales. Indeed, survey responses suggest that Sun, Apollo Computer Inc. (Chelmsford, MA), and "other" vendors comprise a good measure of the Unix micro and workstation market. Taken on balance, purchasing plans for Unix workstations are strong, compared with DOS and OS/2 machines.

Does this give a glimmer of hope that OSF-related turmoil will be short-lived? The answer may lie in the results of our next survey. **D**

This report covers the sixth quarterly survey, cosponsored by DECISIONS and Paine Webber Inc., the Wall Street brokerage, of information executives and managers. The survey was conducted during the last week of May and the first two weeks of June. Questionnaires were mailed to 10,000 information managers in organizations with 5,000 or more employees; 1,170 responded, a response rate of 11.7 percent. The error rate is plus or minus 2.5 percent. The results of this and all previous surveys were tabulated by SPSS Inc. (Chicago), a statistical software house.

The respondents represent a broad spectrum of industries. The largest group is in manufacturing companies (28 percent), with government (19 percent) and financial services (13 percent) being the next two largest groupings. Excluded from the sample were information managers in organizations whose primary business is the manufacturing and marketing of systems and/or software.

Copies of the full report on the Sixth DECISIONS/Paine Webber Survey of MIS Attitudes are available for $295 from Laurie Schnepf, Marketing Manager, Computer DECISIONS, Glenpointe Centre East, DeGraw Ave., Teaneck, NJ 07666.

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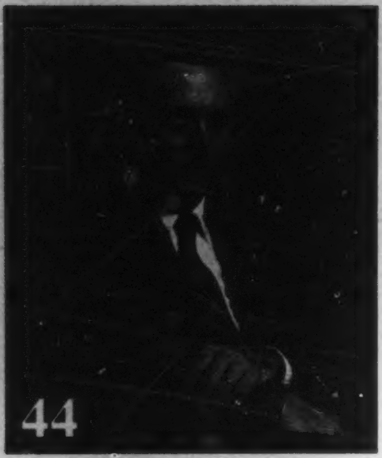
THE INVASION OF THE INTEGRATORS

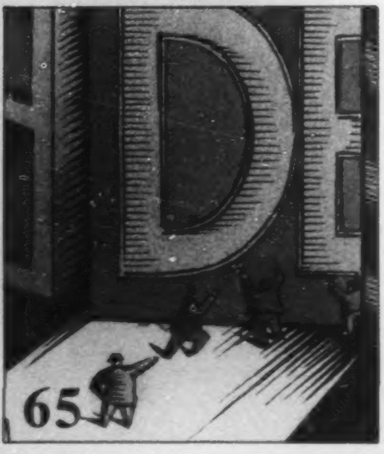
MIXED BLESSINGS FOR CORPORATE STAFF

How To Handle
The VDT Issue

COMPUTER DECISIONS

Vol. 20 No. 10 October 1988





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EDITOR'S MESSAGE

Eyes on the Ripple Effect

When information technology makes news in the general media, the implications can be positive, negative, or occasionally neither. What commonly influences the outcome, however, is an insufficient grasp of the particular technology on the part of both the media and the intended audience. This is one reason that computers often jump from miracle machine to devil's instrument at the drop of a headline.

Any one of these situations is capable of eventually producing problems for information managers; if for no other reason, they are worth tracking. In this issue, we offer two examples of information technology treatment in the media. On page 54, you'll get the real facts on how the complex of health-related issues surrounding display terminals in the workplace was used to engender a unique and precedent setting piece of local legislation in Suffolk County, NY. On page 60, you'll get an introduction (most likely) to a computer package that aims to do what all the combined newspapers, magazines, and TV and radio stations in the United States have thus far failed to pull off: render the average American voter well informed enough to make an intelligent choice at the polls.

In both cases, I believe, the initial interpretation of these developments by those who have neither the time, the background, nor the inclination to delve fully into their technological underpinnings has paved the way for confusion and overreaction. VDTs are obviously not an insidious, malignant scourge in the workplace; neither is any computer program capable of filling a Big Brotherly void created by an apathetic electorate. That it could provide significant benefit or detriment to the fortunes of a particular candidate for public office is even more unlikely. Yet the public reaction, and the reactions to the reaction, may run a far different course than the facts would suggest. And let's not forget that this public includes our peers and top management in our own companies.

As they say in the media, stay tuned.

Robin Nelson

Cover Illustration:
Tim Lewis

open system because it must run as a guest operating system under VM. X/Open recently announced a verification suite for CAE, which will give it more force in the Unix market. Fujitsu, the first Japanese company to join X/Open, must also pledge conformance to CAE. Fujitsu's support is significant, Waxman says, because it is "important that the X/Open standard is indeed international."

IEEE is working on a suite of Unix-based facilities to establish an open operating system environment known as Posix (Portable Operating System Interface). The initial IEEE Posix group, Project 1003.1, incorporates the systems services interface standard. Originally slated for approval by June, an initial model was only recently approved. Because of the delay, an interim, less fully functional Posix standard was adopted by the U.S. National Institute of Standards and Technology (formerly the National Bureau of Standards) as a federal information processing standard (FIPS). Posix standards are "slightly out of synch at this point," says Roger Martin, manager of the Software Engineering Group for NIST, but by spring Posix standards should be agreed on by several standards bodies, including NIST, IEEE, the American National Standards Institute, and the International Standards Organization, according to Martin. This will put Posix in the forefront of Unix standards.

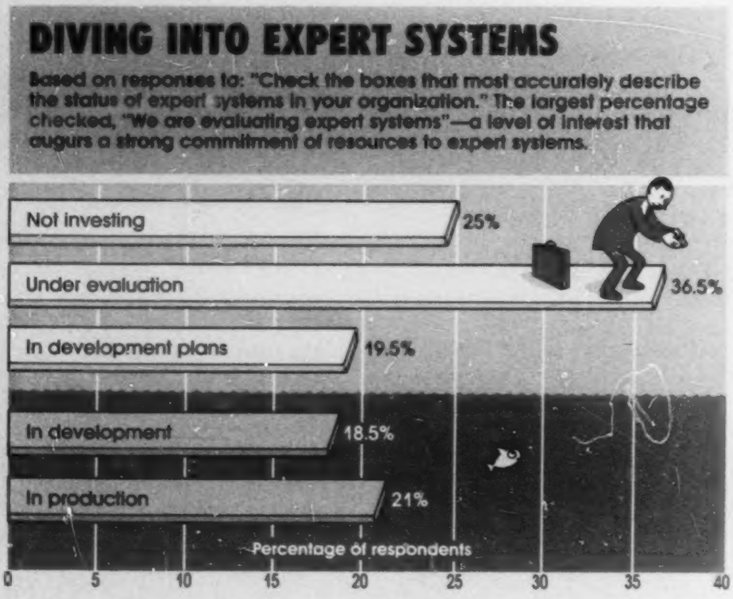
Vendors of Unix products have been busy making announcements. DEC unveiled a new version of its Unix-variant operating system, Ultrix. DEC claims the new Ultrix-32 Version 3 is the first Unix variant to comply with all the major standards models. The new version complies with AT&T's System V Interface Definition (SVID), the IEEE Posix standard, the X/Open CAE, and OSF's AES. It also incorporates several of the Berkeley System Distribution (BSD) features. Ultrix-32 Version 3 features several utilities that promote interoperability. These include the VMS/Ultrix Connection and the Ultrix Mail Connection, both for interoperability between Ultrix and VMS, and DECnet-Ultrix Version 3, which promotes interoperability among disparate systems over TCP/IP (Transmission Control Protocol/Internet Protocol) connections.

Data General Corp. (Westboro, MA) has also announced a new version of its Unix variant. DG/UX Version 4 is compatible with Unix System V Release 3, Posix, and many of the BSD features. The DG/UX kernel was rewritten for better system portability among different hardware architectures, specifically for the Motorola 88000 reduced instruction set computing chip, according to David Ellenberger, director of systems product marketing. Support for other RISC architectures may follow, he says. The new version also provides support for symmetrical multiprocessing—the ability to have multiple processors simultaneously working on multiple problems—and extensible file systems for more efficient I/O processing. DEC has announced a future implementation of symmetrical multiprocessing for Ultrix-32.

Stratus Computer (Marlboro, MA) plans to offer a version of Unix by the end of next year. The first version of Stratus's Unix will feature fault-tolerant symmetrical multiprocessing, the vendor says. Later versions will feature system optimization for online transaction processing. The Stratus Unix will be compliant with Unix V.3 and Posix.

Apple Computer Inc. (Cupertino, CA) also appears to be serious about its Unix commitment, based on statements it made about its Unix system, A/UX, at the Dallas Unix conference. Apple announced that the next version of A/UX will comply with the interim Posix FIPS, and future versions with the evolving standard.

What does all this jockeying among vendors and standards groups mean? As Data General's Ellenberger suggests, "Maybe if everybody joins everything, eventually there'll be a real Unix standard." **D**



DIVING INTO EXPERT SYSTEMS

Based on responses to: "Check the boxes that most accurately describe the status of expert systems in your organization." The largest percentage checked, "We are evaluating expert systems"—a level of interest that augurs a strong commitment of resources to expert systems.

Phil Scheuer

Responses may add up to more than 100 percent. Respondents were asked to check as many categories as applied to their organizations.

DECISIONS chart

Are information managers really interested in expert systems? Based on results of the latest DECISIONS/Paine Webber Survey of MIS Attitudes, the answer is yes. Nearly 40 percent of the survey's respondents indicated they had already taken the plunge into the expert-systems sea by committing resources to expert systems—either by using them in production situations or by having them in development. Another 19.5 percent indicated that they had expert-system technology factored into their future development plans. The largest single percentage of respondents indicated that they were in the process of evaluating expert systems—a response that suggests users are ready to make a headfirst dive into the technology.